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ANNUAL REPORTS

The Academy of Natural Sciences

OF

Philadelphia

FOR THE YEAR ENDING NOVEMBER 30, 1922.

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* Deceased December 30, 1922.



NESTING COLONY OF WAGLER'S OROPENDOLA (*Zarhynchus wagleri*).

REPORT OF THE CURATORS

Special Reports by Members of the Scientific Staff

THE ACADEMY NICARAGUAN EXPEDITION OF 1922

BY WHARTON HUBER.

During the latter part of the summer of 1921, Dr. Theodore W. Bouchelle, a member of the Academy, suggested that an expedition be sent to Nicaragua to study and collect specimens of its fauna, generously offering to act as host after the expedition reached Prinzapolka. Having lived in Central America for some seventeen years, the greater part of this time in Nicaragua, he realized the possibilities for collecting under the most favorable conditions at Eden, where he was then stationed. Very little scientific collecting has been done in eastern Nicaragua in what is known as the Mosquito Coast region, and apparently none whatever in the vicinity of Eden. It was the writer's good fortune to be intrusted with the plans for an expedition and the carrying out of the same for a three months stay in the tropical forest. Mr. J. Fletcher Street, a member of the Academy, accompanied the writer and assisted in the field work. Since we planned to make collections in as many branches of natural history as possible, a considerable amount of equipment and baggage was necessary.

We sailed for Bluefields from New Orleans on March 3, 1922, on the S. S. "Hibueras" of the New Orleans-Bluefields Fruit & Navigation Co.

Shortly after leaving the dock a large flock of Ring-billed Gulls followed in the wake of the ship, wheeling and circling close to the stern, ever watchful for a morsel of food. They continued their graceful flight as we steamed down the Mississippi and out into the Gulf, slowly diminishing in numbers until the coast of Cuba was in

sight, when the last small remnant of the flock left us, disappearing in the direction of Cape San Antonio, the westernmost extremity of Cuba. Very little bird life was observed in the Gulf, a single White Pelican and a Parasitic Jaeger completing the list. Upon entering the Straits of Yucatan a small flock of swallows greeted us by passing close to the ship, the forerunners of many species to be seen before we passed through the Caribbean; and Frigate Birds, whose graceful flight one never tires of watching, Yellow-billed Tropic Birds, and dusky colored Boobies in pairs, whose tandem flight was both swift and graceful.

In the Gulf Stream flying-fish were plentiful, their gauzy fins glistening in the sunlight as they arose in schools close by. Much of our time was spent in the bow of the ship, figuring their speed as they "volplaned" into the wind. This we determined was at about 15 miles per hour, or a little faster; their "flights" were from a few feet to as much as 125 or 150 yards. The fins were not moved in flight but were kept rigid, and the longest distances were obtained when flying directly into the wind. Occasionally, when the flight of a fish was nearly spent, it would strike its tail upon the water, thus elevating its body and continue for a considerable distance further. One of these flying-fish came aboard during the night and we preserved it in formaldehyde.

At nine P.M., March 7, we dropped anchor, one and one-half miles off Bluefields, too late for the pilot to come out that day. Six o'clock the next morning found the pilot clambering up the rope ladder and at seven we were alongside the Customs Dock at the Bluffs. Captain Moore introduced us to Mr. Crompton, in charge of Customs, who had our baggage and equipment passed without the formality of opening. Our thanks and appreciation are due Mr. Crompton, Mr. Le Franc, Mr. Arnaldo Papi, the many Customs' officials, and the representatives of the Nicaraguan Government.

Seven miles across the lagoon from the Bluff is Bluefields, the largest town on the Atlantic side of Nicaragua; attractive from the waterfront, but decidedly disappointing when one moves about the grass grown streets lined with nondescript buildings generally roofed with corrugated iron. What the town lacked in beauty it more than made up in hospitality, comfortable quarters, and excellent food. The next three days were spent collecting birds in the bush back of Bluefields where we took a number of species that

were not found at Eden. Many photographs were taken in and around Bluefields, and we continued to take pictures during our entire stay in Nicaragua, so that when we returned we had about seven hundred negatives.

Before leaving Philadelphia, Mr. Charles R. Miller, Vice-President of the Eden Mining Company, offered to take us on the schooner that was to carry him from Port Lamon, Costa Rica, to Prinzapolka, and continue in his party up the river in pitpans to Eden. This kindness of Mr. Miller's simplified our travelling very much, shortening the time spent on the river, besides giving us the greatest possible comfort and enjoyment. It was therefore a great pleasure to us when we joined Mr. Miller and Mr. Blackburn on board the "Ultramar" at the Bluff, at noon on March 13. The "Ultramar" is a fifty foot, two-masted schooner, of about 40 tons, fitted with an auxiliary engine. At eight o'clock, with a beautiful moon over head, we left the Bluffs, crossed the bar under our auxiliary, then hoisted our sails, and set a course for Prinzapolka, ninety miles up the coast. The trade wind was blowing strong, and the sea very rough, so we stayed close to our mattresses spread on top of the engine house. Many times during the night the mattress slid with the pitching of the schooner, and I thought that I would land in the scuppers, or on the back of the big black hog that roamed the deck as a mascot.

There is very little water on the bar at the entrance to the Prinzapolka River and in crossing we struck several times. Large steamers that load mahogany logs anchor well off the coast, and the logs are rafted and towed off to them by power boats. We reached the wharf of the Tunky Transportation Company at ten o'clock, and our equipment was immediately transferred to a pitpan.

All the arrangements for the river journey of 180 miles to Eden having been made by Captain Osmond Thompson, we were free to observe and collect a few birds. Two pitpans each fifty feet long, five and one-half feet wide, and hollowed from a single mahogany log, with a canvas cover over the middle long enough to shelter our air-mattresses from the rain, were lashed on either side of a gasoline power boat. Mr. Miller and Mr. Blackburn occupied one pitpan; Mr. Street and myself the other. Captain Osmond Thompson, a cook, and ten Moskito Indians, made up the balance of the party. We left the wharf of the Tunky Transportation

Company a little after six o'clock, and darkness, almost immediately following the setting of the sun in this latitude, fourteen degrees north, was already upon us. A full moon cast its silvery light through the giant tropical trees, silhouetting wonderful fantastic castles and other grotesque forms against a brilliant starlit sky. Here and there were great palms that furnished quantities of nuts to the United States during the war, to be burned into charcoal for the making of gas-masks. Now and then the weird cry of a night-prowling animal or bird, and above all the steady swish of the water against the bows of our pitpans, leave pleasant memories of a night never to be forgotten.

Daylight found us in the Banbana River, much narrower than the Prinzapolka, but even more beautiful. Forest giants everywhere with their leaves of many shades of green; now and then a cotton tree towering above its neighbors with a colony of Oropendolas, called in Nicaragua Yellow Tails, decorating its topmost outer branches with a dozen or twenty long brown flask-shaped nests, four or five feet in length. Herons, blue and white, Egrets, Wood Ibises, and even our own familiar little Spotted Sandpiper, flew from some favorite spot along the bank at our approach. The Iguanas, or Cocomos of the Moskito Indians, basking in the sun along the banks, or feeding on the younger leaves of a bamboo, were seen in abundance, for March is the month when the Cocomo lays her eggs, forty to sixty in number, buried in some sandy sunny spot. The eggs and meat of the Cocomo are much sought for food by the Indians, the meat tasting like frog legs or very tender chicken. An occasional Crocodile, basking in the sun, scurried from its watchful sleep with a splash, and was seen no more. Overhead, long-tailed, harsh-voiced, Red, Blue and Yellow Macaws, flew in pairs or small flocks, interrupted in their feeding, or love making, by the put! put! put! of our tow boat. Yellow-naped Amazon Parrots, a pure white Cotinga, and birds of many and gorgeous colors, claimed our attention as we wound our way around the many bends of this swiftly-flowing tropical river. Distance is known not in miles, but in the number of bends, for there are, I am told, over three hundred of them between Tunky and the Banbana mouth.

Ten o'clock that evening found us at the foot of the Walpatara Rapids, the longest and most difficult at all seasons of the year on this river, and here we tied up for the night.

With the first peep of day a rope four or five hundred feet long was taken ahead by the Indians and attached to a windlass near the head of the rapids, the other end to the bow of our pitpan, as we were to be the first to go up. Four Indians manned the windlass and the rest of the crew, each with a long sharpened pole, took their stands on either side of our pitpan, all stripped to the waist. Thrusting the sharp points of the poles into the crevices of the rock bottom, and with a yell, the Indians threw their weight upon the poles, and we started moving into the rapids. Keeping a course as near the bank as possible in order to take advantage of the shallow water and least amount of current, we could hear the click of the poles against the rocky bottom as slowly but surely we were forced through the roaring torrent. Up, up we went, the boys at the windlass winding taut the rope, holding every inch gained by the polers, yelling and chirping as they strained against the poles in unison. Now we grounded upon a rock, a poler changed his place to lighten that side, we were off, shipping some water as we reached a particularly turbulent spot, but on we went. Just ahead was an exceedingly rough spot, where the water boiled and roared over large hidden rocks; we reached it and water dashed into the boat, and we wondered if enough to harm our equipment. With a shout the Indians strained at the poles as the sweat streamed from the taut muscles of their brown backs and arms. More sweating and straining at the poles as we were forced slowly through the last stretch of turbulent waters; then with a lusty shout in which we joined we glided smoothly into the quiet waters, above. We tied up to the bank, the water was bailed out of our boat, and the Indians went to bring up the next one. The tow boat was the last to come up; drawing more water and heavier, it was a greater strain upon the Indians. The Moskitos are without doubt wonderful boatmen and endowed with great strength and endurance. All three boats were now above the rapids and lashed to the tow boat we proceeded up stream, while we ate breakfast. Two more rapids were encountered in the next three hours, but as they were neither as long, nor as turbulent as Walpa-tara, the windlass was not used; we were poled up again singly.

We reached Santa Rosita at eleven o'clock and Tunky at four, a village of thirty or forty houses, most of them vacant, two or three stores and the bodega, or warehouse, of the Tunky Transportation

Company, where we spent the night. After an early breakfast, we embarked in Mr. Miller's pitpan at half-past six for the last leg of our river journey, seventeen miles up the Tunkya to Miranda. The baggage in two small pitpans left long before daylight, as the tow boat and our large pitpan were to remain at Tunkya, while we were to be poled up, as the river was too shallow even for the use of paddles. This was a day of exceedingly hard work for the Indians, many swift shallow rapids, outcropping rocks and very low water were encountered; we were aground almost continuously. In many long stretches there was not enough water to force the boat ahead with poles, and the Indians were compelled to get overboard and drag it across the rocks. Except for the shallow water and the hard work of our Indians it was a beautiful trip, with great trees on either bank whose branches met over our heads, clumps of bamboo, palms, and tree ferns.

Settlements of the Sumo Indians with their open-sided palm-thatched huts, always at the foot of a small rapid and the ever present Supa Palm growing near by. Sumo women washing clothes and beating them on a flat rock; children on the bank answering the bickering of our Indians,—for the Mosquito Indian believes he owns the Sumo, body and soul, usually taking what he wants as he passes by. A pair of beautiful Sun Bitterns kept just ahead of us, flying from rock to rock and uttering a harsh cry from time to time, always keeping just out of range until they finally disappeared into a tangle of wild cane.

Sun Grebes were seen swimming amongst the foam in an eddy at the foot of a rapid; as we came nearer they would fly to the lower limbs of a tree hoping to escape our notice; then at the grinding of the boat on the rocks they would take flight and disappear around a bend in the river to repeat the performance later. A troupe of twenty-five or more Mantled Howler Monkeys made the forest echo with their weird harsh howling. As we rounded a bend in the river at three o'clock in the afternoon, we saw the wharf at Miranda, perched high on the left bank, well out of each of the floods that sweep down all tropical rivers in the wet season. Here Mr. Davey, temporarily in charge of the Eden Mine, loaded us all on top of the baggage on a small flat car, and a very efficient gasoline locomotive hauled us seven miles over the only railroad in eastern Nicaragua to Eden, where we were to make our headquarters. A few minutes



UPPER.—SUMO INDIAN HOUSE, TUNKY RIVER.
LOWER.—NATIVE BANANA PLANTATION, EDEN.

after our arrival we were greeted by the first rain since we left Bluefields. We had had five consecutive days and nights without rain, and we were not to see such a dry spell as this again in the three months following.

The little mining town of Eden is situated on the eastern side of a range of mountains, 1500 to 2500 feet in height, in the center of what is known as the Pis Pis Mining District.

All of the surrounding mines were closed down during our stay, the Eden Mine only producing gold. The town built entirely by the Mining Company, is a model up-to-date plant including hydro-electric plant, cyanide mill, machine shop, saw mill, ice plant, a well-stocked store, staff house, and other necessities in a tropical mining community. The staff house, a two-story frame building in the shape of a U, with porches extending around the entire building on both floors, supplied extremely comfortable living quarters for twenty-five or thirty persons. We occupied a large second-story room on the north corner and every thing possible was done for our comfort. From the porch at an elevation of 700 feet, we had a fine view of the surrounding mountains and cleared *patrero*, with its grazing cattle, fattening for beef. The porch in front of our room answered admirably for our workshop, where we skinned and made-up our specimens in the daytime, while at night we worked in our room amply supplied with electric lights. Electric lights were hung at regular intervals on both porches and in the basement, two sides of which were open. These lights at night attracted great quantities of insects of every description, affording a wonderful opportunity to collect many rare forms that otherwise we would not have found. By hanging sheets of white cheesecloth behind some of these lights, several thousand night flying *Lepidoptera* were added to the Academy's collection.

Field work began at six in the morning, with a tramp into the surrounding forest to collect birds and mammals, returning about eleven for a shower bath and lunch. The afternoon, and generally until eleven or twelve at night, was taken up in skinning and making-up the specimens secured in the morning, for in this hot damp climate they spoiled very quickly. The forest round about Eden was extremely difficult to get through as the heavy undergrowth matted and tangled, formed a barrier no one could penetrate without first cutting a trail. The immense buttresses of the

larger trees, fallen and rotting giants covered with parasitic plants, with lianas three inches in diameter to the size of small wires, trailing the ground from the higher limbs of the trees and the slippery soil under all, made successful snares that only too often brought us to earth with a realization of their hidden powers. Trails there were in many directions and these we followed in much of our hunting, but upon shooting a bird another trail must be cut in order to retrieve it and more than once did I have to call Henry, our faithful Indian boy, to cut me out when I had all but secured a fallen specimen. Henry with his machete, that indispensable daily companion of the Central American Indian, was with us always and served us well. The hills, the valleys, the streams and the clearings were scoured and combed, yielding daily their quota of birds, beats, and insects to the collection. Fish were collected in all of the streams encountered, either with a small mesh seine that we took for the purpose, or by exploding dynamite in the deeper holes and eddys. Three species of freshwater fish new to science were thus secured. Many specimens of reptiles were shot during the daytime; and at night, others attracted by the use of electric torches or acetylene lamps, were caught in butterfly nets, and all were preserved entire in formaldehyde.

Eastern Nicaragua like all tropical-forest countries has a wet and a dry season, March, April and most of May constitute the so-called dry season, while the balance of the year is given over to the wet. The Eden Mining Company has for a number of years kept a careful record of precipitation and finds the average rainfall for the year to be 145 inches. The daily temperature varies between 80 and 95 degrees in the shade, but in the sun it is very much higher; at night it is generally cool enough to require a thin blanket. Hardly a day passed that we did not have showers, sometimes almost continuous, with here and there a dash of sunshine, yet this was the dry season. Our clothing while in the bush was nearly always wet, either from the heavy showers or from perspiration due to the steamy heat. This excessively damp atmosphere made the drying of bird and mammal skins and the preserving of insects, a painstaking operation, for a humming-bird skin that would be fairly dry in two or three days here at home, would show very little signs of drying in two weeks at Eden. A supply of very light wooden trays, knocked down, to be put together in a few minutes,

were taken in our equipment. The skins as made up were laid in these trays, plentifully dusted with powdered naphthaline to prevent mould and keep out the ever-present ants and cockroaches. Between showers they were arranged on the porch in the sun, shaded from its direct rays by cheesecloth and when a shower came up, which was often, they were hurried into our room to be brought out again as the sun appeared. At night they occupied every available spot in the room. Moths, butterflies and other insects were dried in a much simpler manner. A large box-like closet with shelves and a 75 watt electric light at the bottom, served as a drying cabinet. The specimens placed between layers of cotton, or in paper folders in tin canisters with plenty of naphtha flakes, were dried by the heat from the electric light, then sealed with adhesive tape to keep them dry and keep out ants. While the drying and preserving of specimens occupied much of our time, it was simple compared with what we would have found necessary had we lived in a tent or thatched hut, which is often the lot of collectors in the tropics.

On the eleventh of April we made a trip by pitpan down the river to Santa Rosita, where we spent a week collecting birds quite different from those found at Eden. Here we saw for the first time numbers of *Ibicter americana*, an exceedingly noisy species of Caracara. It is called by the natives Ka-Ka-Ka-Ka from the harsh call of the birds. Seven of these Caracaras were perched upon the ridge pole of the thatched roof of a Sumo house vieing with each other for vocal supremacy. The crops of those that we collected were gorged with wasps. Here also we found a pair of Nun Birds, their bright red bill, with a white ruff of feathers at its base, giving a queer effect to the sombre grayish-black body. Numerous other species were found here only. Making our headquarters in the abandoned and partly tumbled down office building, we had a good place to work and a dry bed to sleep in. It was here only that we were bothered by mosquitoes while in Nicaragua. About half-an-hour before sunset they came out in swarms, driving us to our beds under the mosquito nets, and preventing any work in the evenings. They were also very numerous in the forest during the day, keeping us continually on our guard.

One night was spent drifting down the Banbana River with a jack-light in search of Tapirs and other night-prowling animals.

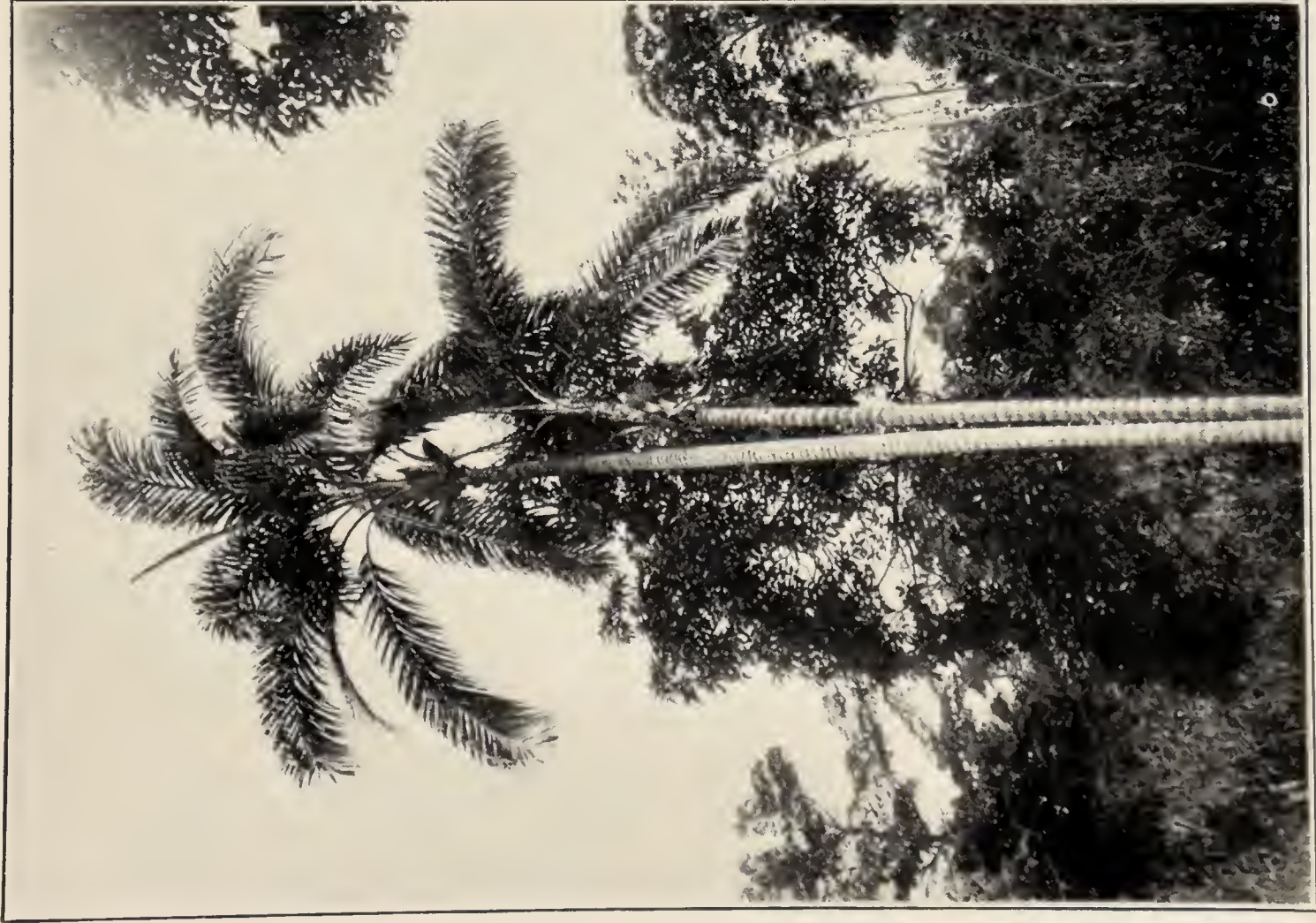
While we heard Tapirs breaking through the bamboo several times, they failed to appear for their bath. A full moon came up about midnight, silhouetting the long slim bamboos over our heads against its silvery light making them look like giant ostrich plumes, as they waved and glistened in the gentle tropical breeze. Such a night of enchanting beauty fully repaid the disappointment in not seeing a Tapir. Mr. Street did, however, collect one on his homeward trip to the coast in May.

Shortly after our return from Santa Rosita we made a trip across the mountains from Eden to the Great Falls Power Plant that furnished electricity for the mining operation.

This time we travelled the eight or ten miles on mule back, taking the greater part of a day for the journey. Trails, or roads, in this part of Nicaragua are very bad even during the dry season, making progress extremely slow. Owing to the great amount of rain, and the soft nature of the soil, they are worn into deep holes or ruts, known as bull hummocks, giving a washboard effect. These bull hummocks are caused by the oxen or mules stepping in the same place each time and wearing deep gullies, the ground between the gullies standing in high ridges. Much of the time the gullies are full of water, causing the mule to flounder down to its knees, the ridge often touching its belly. Frequently as the mules splashed through the hummocks, my feet would touch the ridges, and one can easily imagine what mud-bespattered objects we were upon reaching our destination. I cannot pay too high a tribute to the surefootedness of the mules, for they kept their feet on the steep slippery hillsides, jumping over fallen trees across the trail, wallowing in mud-filled holes belly deep, or slowly picked their way along a slippery loose-rocked ledge.

Mr. J. S. McKenzie, electrician in charge, accompanied us and acted as our host the week we spent at the Falls, and as his spare time permitted, joined us in our hunting, assisted in the skinning of mammals or collected insects at night around the lights, thus rendering valuable aid in our work.

We lived in the comfortable quarters erected for Mr. McKenzie, on the hillside overlooking the Pis Pis River, which flows into the Waspuc, thence into the Wanks, finally discharging its waters into the Caribbean at Cabo Gracias á Dios. Collecting along the river and on the surrounding hills netted us many species of birds new



SUPA PALM (*Guilielma utilis*).



ORCHID COVERED TREE, PIS PIS RIVER.

to our collection; in fact not a day passed here without adding four or five species not previously taken to our list. Several months could easily have been spent in this section and, even then we would not have taken representatives of all the species either resident or passing through the forest in waves. The bird population was here more numerous, both in species and individuals, than at any other spot we visited.

The Tinamous or Mountain Hens, as they are locally called, were often heard in the surrounding bush especially about six o'clock in the evening,—hence the name Six-o'Clock Bird, a common venacular. Extremely shy, and hard to distinguish from the ground of the forest in their olive-brown plumage but we nevertheless succeeded in collecting a fine series of them. A large colony of Wagler's Oropendolas decorated four large trees in front of our door with their nests, until they looked like huge Christmas trees. There were over one hundred pairs of these birds in the colony; they were extremely tame, and we were very careful not to disturb them by shooting near the nesting trees. Several fine mammals, including a *Nasua*, a Rabbit, and fine pair of Mantled-Howler Monkeys were obtained. On our way back to Eden a Tamandua, a small form of Anteater, was shot from a high tree while in the act of eating termites from a large nest.

Owing to the press of business, Mr. Street was compelled to return home the first of May. I remained at Eden continuing the work, with another short visit to the Falls, until June fifth. Early in May, a large band of Mantled Howler Monkeys visited the forest above the Staff House, making the hills echo with their weird cries. The collection needed Howlers, and suffice it to say twelve fine specimens were obtained, fathers, mothers, and babes-in-arms, enough for a group and a series for the study collection, including skulls of all and entire skeletons of several. The skinning, curing the skins, and roughing out the skulls and skeletons of twelve large monkeys in a hot climate, is a continuous and towards the end none too pleasant job, especially to the olfactory nerves. The smaller mammal skins were made up on the spot into study skins; the larger ones were cured with salt and packed in a barrel between layers of salt, as I found it impossible to get the skins dry in such a moisture-saturated atmosphere. With the approach of the rainy season, the heavier and more frequent showers turned

the already muddy trails into almost knee-deep mires, making walking extremely slow and tiring. The greatest difficulty was to keep the specimens and butterfly net dry in the field, even after wrapping them in a rubber poncho; by the time I reached the Staff House the birds looked as if they had been fished from a creek.

From the middle of May collecting was carried on in almost a continual downpour, with hardly any sun at all to dry the specimens, so that I discontinued field work the 24th of May, and started to pack up the collection. This was by no means an easy task for they were to travel over 2500 miles, most of it more or less exposed to the rain and certainly in great danger from ants and cockroaches that at all times infest banana-carrying steamers. I was fortunate in securing a good supply of large square tin boxes, with tight-fitting circular lids, used to ship dynamite to the mine. A handful of naphthaline in each tin, to keep out insects and prevent mould, and the tin enclosed in a wooden box, brought the specimens home in perfect condition.

On June 5th, at seven o'clock in the morning, I bid good bye to my companions at the Staff House, whose pleasant companionship will always be remembered. The collection and equipment were loaded on a flat-car and covered with a tarpaulin and Dr. Bouchellé and I crawled on top with a number of employees. Henry, the Indian boy, was there too as he was going home to Sandy Bay, on the coast between Prinzapolka and Cabo Gracias á Dios.

As we left Eden it rained, almost continuously for two days and nights. Arriving at Miranda, the baggage was loaded into three pitpans and covered with tarpaulins.

At Miranda, I left Dr. Bouchelle, knowing that I should welcome him in Philadelphia before the end of the year.

What we accomplished in Nicaragua was due entirely to Dr. Bouchelle; ever watchful of our health, our comfort and the thousand-and-one things that go to make an expedition a success in the field.

There being now plenty of water in the river, the crew of Sumo Indians made good time with the paddles. Although it rained continuously, I stopped at the three Sumo settlements to take pictures, with very fair success. Arriving at Tunky, the baggage was transferred to a fifty-foot pitpan with a crew of seven Moskito



UPPER.—A STREET IN AN UPLAND TOWN, WITH CHILDREN OF THE CHIBCHA INDIANS,—ZAPAQUIRA, NEAR BOGOTÁ.
 LOWER.—RANCH-HOUSE AND GROVE OF PLANTAINS ON THE PLAINS OF THE META NEAR VILLAVICENCIO.

In the footnote on page 15 of this report the names of Mr. Ellsworth P. Killip of the United States National Museum and Dr. Tracy E. Hazen of Columbia University, the other members of the party, are inadvertently omitted.

Indians, I crawled under the tarpaulin, and we were off. The Banbana River was partly in flood, so we made fast time under the six paddles, passing through the Walpa-tara Rapids at nine o'clock that night during an unusually heavy downpour of rain. The river gained in flood as we neared the Banbanamouth, and so did the rain, keeping the Indians bailing frequently to prevent the water reaching my bed and baggage. I was not at all loath to leave the pitpan at eight o'clock on the morning of the 7th and see my baggage put in the warehouse at Prinzapolka.

The Schooner "Star" put in on the 12th and took me to Bluefields, whence on the 18th I sailed for New Orleans.

We had collected mammals representing about twenty species; six hundred and twenty-five birds representing over two hundred species, two or three apparently new to science, together with twenty-six sets of eggs with their nests, about a thousand specimens of fish and reptiles, and some seven thousand insects.

THROUGH THE ANDES OF WESTERN COLOMBIA*

BY FRANCIS W. PENNELL.

Travellers, especially botanists, could not ask for a finer introduction to any country than is afforded by the railroad ride from Buenaventura on the Pacific coast of Colombia to La Cumbre, near the summit of the western Andes. The succession of scenery, from the near and intimate view of the Tropical forest with its richness of detail, on through the gorge of the Dagua River and up to an elevation where the eye obtains a vast view of the summits of two Andean cordilleras, affords most remarkable and beautiful contrasts. The change in plant life from the shore and the heavily-wooded lowland to arid slopes, with distant views of prairie or mountain forests, is as botanically interesting as it is fascinating. There were three of us taking this ride one morning in early May, 1922. We were entering Colombia for the purpose of botanical collecting

* Account of an expedition for botanical exploration undertaken jointly on behalf of The New York Botanical Garden, Gray Herbarium of Harvard University, United States National Museum, and the Academy of Natural Sciences of Philadelphia. The party consisted of Dr. Francis W. Pennell of the Academy of Natural Sciences of Philadelphia, and Mrs. Pennell.

and exploration in the Central and Western Cordilleras of the Andes.

The train passed first across the mangrove marshes which skirt for many miles the western shore of Colombia, forming a uniform ribbon of dull green. Then passing inland and slightly upward, we entered the most luxuriant of tropical forests. Along the Pacific coast from Panama to Ecuador, this forest covers the lower slopes of the Western Andes, there catching the winds from the ocean and receiving the heaviest rainfall of the New World. Vegetation is rank, and the flora contains a high proportion of plants belonging to families which prefer humid warmth. Wild bananas and their relatives abound, as do the massive herbs and succulent climbers of the Aroid family. Bamboos and palms are common. Back in the forest, tree-growth is so dense that little light breaks through. There is a great variety of trees in a tropical forest but little bloom is seen, so that the forest, for all its exuberant wealth of foliage, is decidedly sombre. Along the river course, and through the gorge of the Dagua, we saw most attractively the lowland tropical forest.

Less than a score of miles from the wettest phase of this forest, above the curving gorge of the Dagua River and in a pocket, so placed that the winds from the Pacific have been previously intercepted by the first outlying ridge of the Andes, we entered an open grass-covered valley, so dry as to inhibit any growth of forest. As the train wound its way between the steep slopes we could see each stage of the transition. Below the gorge were giant Aroids, their leaves as massive as the well-known "elephant-ears"; above the gorge were giant leafless Cacti. Shrubs with silvery or yellowish leaves were typical of the upper Dagua valley.

At the town of Dagua, in the open valley, the train left the river and wound its way upward, curve upon curve. The upper grasslands into which we entered had at this time numerous flowers,—and very beautiful were the various species of ground orchids with their clusters of yellow, orange, or red flowers. Where rain is seasonal there will always be a time of beautiful bloom.

The town of La Cumbré, where we made our first collecting base, is situated near the summit of the Western Andes. Here we could descend to open tropical slopes, or ascend into the subtropical forest. This forest of the mountains is far richer in air-plants than is that

of the lowlands. The cup-like Bromeliads and the endless variety of epiphytic orchids form a rich world of life in themselves. We spent only three weeks at La Cumbre, although indeed the whole five months of our stay in Colombia could have been well spent obtaining the flora accessible at that station. However, our mission to collect and compare the floras of the upper zones of life of the Central and Western Andes, called us to go further inland and to higher levels. The Western Cordillera near La Cumbre rises from the tropical into the subtropical zone of life, but still higher occur two other life zones, the temperate or cool zone, and the paramo or cold zone.

To reach these the upper slopes of both the central and western Andes was possible from the deep intervening trough of the valley of the Cauca River. Before we descend to this valley from the western range, let us pause and see one of the most famous Andean views. On either side, north or south, the Western Cordillera rises far-away to heights much greater than our low pass; before us is the open, floor-like, yellowish-green Cauca valley, the course of the river showing as a winding silver thread; across the valley, some fifty miles away, the foothills of the Central Cordillera rise sharply, their bases bare but, just above, their flanks sheathed and coated with deep green forest. Perhaps we see these hills soon passing into cloud, or we may have the good fortune to see them dwarfed and grouped at the foot of the great mass of the Central Andes, the high chain that, as a rampart reaching repeatedly to snow, cleaves Western Colombia from south to north. The Western and eastern Cordilleras in Colombia rise here and there to like altitudes; but neither maintains the height of the Central Cordillera.

Away from this entering railroad there are not even roadways by which to reach the cordillera, so that the problem of arranging for transportation is the first which must be considered. Our first expedition into the Cauca valley resulted in the purchase of a riding mule for each of our party and four for cargo. These were procured in the neighborhood of "La Manuelita," the estate of Sr. Henry Eder from whom Dr. Chapman's ornithological helpers had received such courteous aid. We left Cali, a thriving town with a modern atmosphere, and after a few hours by train to the end of the present railway at Aganche, changed to our mules and spent three days of leisurely travel journeying to Popayán.

We all needed to become accustomed to the saddle and to the individual personalities of our mules. A good mule soon becomes a docile helper to a plant collector, permitting him to ride to the side of the trail or into bushes after flowers. But there is a Colombian saying that "a mule will be always a mule," and a few thrilling occasions leave intact my belief that our beasts were genuine mules.

We rode into hills covered with a chaparral shrub growth, and where the gorgeous "flor de Mayo" (flower of May), made an unforgettable impression. This Colombian favorite, of the tropical family of Melastomads, is a bush or small tree with large flowers, the petals of which are on opening a glorious pink-purple but later change to a deep violet. Nearer Popayán and in the same arid phase of the subtropical life-zone we saw our first oaks. These are stately trees, with glossy leaves that in form suggest a shingle or a narrow-leaved chestnut oak. On my earlier expedition to Colombia, which had taken me from the tropical lowland to above timber line on all three cordilleras of the Andes, I had come to consider that the Colombian oak was the surest indicator of the arid subtropical zone. Throughout the present trip it was found as consistently at this elevation and constantly denoted a dry-life phase of this zone of life.

Placed in the subtropical zone of life, Popayán has a delightful temperature the year round,—the temperature we associate with late May, or early June. Fever-carrying insects and tropical plagues cease with the true tropical lowland, and in a climate without any winter there seems to be no menace to health. The city is beautifully situated at the base of the foothills of the Central Andes, with a clear view across the valley westward to the ridge of the Western Andes, rising to Santa Ana and Cerro Munchique. Behind and above the city, in the Central Andes, is the snow-covered summit of Puracé, an almost continually smoking volcano. As should be expected from such an environment, Popayán is one of the most interesting of Spanish-American cities. Dating from 1536, founded by Belalcázar on his journey north from Quito in search of "El Dorado," it has been throughout its history a chief governing and intellectual center of Colombia. Our residence there of more than six weeks,—our home, as guests of the Department of the Cauca, in an ancient and now abandoned Spanish convent—gave

us the privilege of sharing in the social life of the city and of realizing its many choice features. Popayán was the home of Caldas, the scientist and patriot martyr of the wars of independence, and later of the botanist Lehmann, German Consul and enthusiastic explorer. Indeed, our interest in Popayán, beyond the desire to study from so favorable a point of access the vegetation of the cordilleras, lay in the desire to collect for North American herbaria the many species of Lehmann's, previously known only from specimens that had gone to Europe.

We reached both the Central and Western Cordilleras from Popayán. The latter brought us into the most abundant orchid life that I had ever seen; but the former took us to the higher altitudes which were more properly the goal of our expedition. As guest of Dr. Julian Uribe Uribe, we visited his cottage on the slopes of Puracé, and from there climbed over the ash-covered paramo to the volcano's crater, and as guests of Sr. Ignacio Muñoz we visited the delightful hill estate of San Isidro, and thence went up to his cool forest ranch of Calaguala, and to the paramo summer cottage of Paletará.

As one leaves the city and climbs the hillsides east of Popayán, the open or shrub-covered slopes give way but slowly to the cool highland forest, forming the zone which has been called temperate, not only from its mild temperature, but also because of the occurrence at this elevation of so many forms of life characteristic of the far-away north and south temperate zones. With *Melastomads*, *Rubiads* and such tropical groups, one finds species of buttercups, geraniums, chickweeds, and groups familiar to us in the northern United States and Canada. A traveler from Argentina or Chile would have found even more that was familiar as *calceolarias*, *fuchsias*, and *nasturtions* grow in this cool zone, northward, high in the Colombian cordilleras, and southward descending to sea-level. The unraveling of the elements of the flora of the temperate and paramo zones of the northern Andes, explaining their origins, and the critical comparing of this life upon different cordilleras and isolated ranges, offer a most attractive problem both for botany and geography.

But in the challenge to the mind offered by the composition of this flora, we must not lose the actual picture of the temperate forest as we saw it at Calaguala, above Popayán. I have seen the tem-

perate zone in many localities in Colombia, but my most vivid impression of it is this forest at Calaguala. Never have I seen tree limbs so heavily laden with air-plants; never have I seen the forest in a more perfect setting. The temperate forest has not the tumultuous riot of species that characterizes the tropical and subtropical zones; and the same species will recur in sufficient abundance to give character to a vista. Look from the hill above Calaguala eastward into the forest. The trees appear as in a park, and one discovers with surprise that this appearance is due to the forest having been actually cleared for pasturage. Only the undergrowth has been cleared and the forest floor planted to shade-loving grasses. Every forest tree remains in its proper beauty, and the great green trees with their wide branches form a magnificent scene in themselves. Contrasting color is given by the load of air-life which the branches bear, especially by the rich purple maroon of the upright cups of a certain Bromeliad. Delicacy and a certain mystery are added by the tints of pale yellow-green, given by the slender pendent growths of an air-lichen. Beyond, behind, and on above the forest, forming a background as majestic as beautiful, lie greenish-brown fields of grass reaching up to snow. Such a background to such a forest is incomparable.

Paletará is only a few hours from Calaguala, and the summer cottage of Senor Muñoz is placed above the swift brown current of the Cauca River, here near its source. Paletará is actually a broad meadow, some ten miles or more across, enclosed among hills and appearing to have been once a lake. On all sides it is surrounded by forest, and yet its vegetation is true paramo. One goes *down* from the forested hills into a prairie filled with plants which normally grow only *above* timber-line. This anomaly occurs elsewhere in similar ancient lake basins of this mountain-mass, although only at elevations nearly up to true paramo. I suppose that the explanation of this distribution must be that the open sweep of miles of prairies gives opportunity for winds so driving as to inhibit tree growth. Later in the expedition, I saw shrubs and small trees growing on steep banks almost up to the snow itself.

Paletará was our nearest approach to the equator, about two degrees north latitude, yet never have I felt more chilled than during the three days of our stay. In constant driving rain and fog,—“paramo” such weather is called, with a temperature of 35 degrees



UPPER.—A PALM IN THE TROPICAL FOREST AT VILLAVICENCIO, META.
 LOWER.—A MEADOW OF "FRAILEJONES," *Espe'etia*, ON THE PARAMO DE
 CRUZ VERDE, IN THE EASTERN ANDES NEAR BOGOTÁ.

Fahrenheit, and in a cottage unadapted to winter, one would be chilled enough. Our few days must be all used, and so each day I went out over the paramo moor and once up through the forest and shrub fringe to the edge of true mountain paramo itself. Every excursion was amply successful, although after each trip half the night was needed to separate from a soaking cold mass of vegetation the minute paramo species.

Just as there are fewer kinds of plants, trees, herbs, or air-plants, in the temperate zone than in the zones below, so here on the paramo one finds a yet more impoverished flora. The plants are herbs or low bushes. There are many grasses, sedges and rushes, and along the streams the aspect is that of far northern moors; but certain peculiar plants give the uplands a character very distinctive character.

The most characteristic plant of the Colombian paramos throughout the various highlands of the Andes is the "frailejon," *Espeletia*, a cycad-like plant whose woody stem, clothed with the dead leaves of former seasons, bears at the summit the leaves of the present year, with the flower clusters of small sunflower-like heads. The plant,—stem, leaves, flower stalks and heads of flower—is densely clothed with soft hairs. Each isolated region of paramo appears to have developed its peculiar "frailejones," and the species of Paletará was not the species seen later in the northern portion of the Central Andes. Probably, could we know all the species of "frailejones," where they occur, and how they are inter-related, the information rightly interpreted would go far toward reconstructing the course of recent geologic history in the northern Andes.

"Frailejones" are large and stout and are well coated with protective wool. More numerous in kinds are the paramo plants which are dwarfed to a simple rosette tuft of leaves, or have the stem short and prostrate against the soil. We found gentians of tiniest size, yet each a star of finest blue; there were small Lupines; and minute dandelion-like plants, with a circle of leaves, just peeping from beneath the rim of the single head of flowers. But to the paramo and its life, reaching even higher altitudes and touching snow, we were to return when in the Quindio.

On the 12th of July, we left Popayán for the journey to Cali, from which city my wife returned via Buenaventura and Panamá to the

United States, while Dr. Tracy E. Hazen, of Columbia University, joined Mr. Killip and myself for the journey into the Quindio.

The northern Central Andes, locally known as the Quindio, afforded an excellent opportunity to study the distribution and composition of the flora of the high Andes.

We proceeded down the Cauca River by steamboat from Cali to the little port of Zarzál. There our mules were waiting and we started at once eastward to Armenia and Salento. The route to Armenia lay across the tropical valley of the Cauca and was chiefly memorable for the vast groves of bamboos seen. Indeed, a band of vegetation just below the base of the cordillera must have been originally one almost solid growth of bamboo, forty or fifty feet in height. There were also many palms.

At Salento, a small town on the middle western slopes of the Central Andes, we rented a house surprisingly adapted to our needs. From this base, excursions were made into the surrounding forest, but our chief interest again took us to higher levels. Mr. Killip and Dr. Hazen took the journey over the historic old Quindio trail, returning via the new graded trail recently built by the government, some miles south of the old course. Mr. Killip spent some days in the capitol of Colombia, Bogotá, a city well known to me through three months' residence in 1917. So in August I went, by invitation of Sr. Alfonso Tobón, nephew of the President of Colombia, to his mountain estate of "Alaska," where I was soon joined by Dr. Hazen.

"Alaska" deserves its name. The estate is placed high on the side of the Cordillera, and the ruthless methods of Sr. Tobón's predecessors have changed a region originally covered with most beautiful forest into a bleak desolation. In order to form pasturage every vestige of forest has been cleared, the scrub cut, and old logs burned. One wonders how many years will go by before Colombians regret heartily a policy of utter forest destruction. It seems pitiful, too, to see with what zeal settlers in the virgin beauty of a forest loaded with luxuriant epiphytes, will plant the Australian *Eucalyptus*, a tree whose gray-blue foliage and bare branches seem better fitted to city streets.

We wished to go above "Alaska," so, by the planning of Sr. Tobón and with a small party of his friends, Dr. Hazen and I went up for several days of camping on the paramo. We were

conducted to a valley just below the snow on the Paramo del Quindio, the peak whose name has also been adopted for the whole group of these mountains. Here camp was placed in the midst of the beautiful alpine "frailejones." We piled the leaves of the "frailejones" over the floor, thus forming a deep, soft, aromatically fragrant mattress, and the stems covered with old leaves we placed behind our tent to form a most efficient wind-break. Having secured every side of the tent in this manner, we were comfortably warm although the temperature each night was freezing on the paramo, and one night snow fell.

I had once before been on Ruiz, another peak of the Quindio group some forty miles north of our present base, so I knew what would be some of our trophies on the paramo here. The golden "frailejon" is the largest species of *Espeletia* known to me, and its massive stems, sometimes eight or ten feet tall, when grouped, form groves of a strange peculiar majesty. The leaves are clothed with soft wooly hairs, silvery or golden-yellow; indeed, the richest hue of gold that I have ever seen is that of the hairs of certain of these "frailejon" leaves. Other plants, conspicuously clothed with wooly coats, were a species of lupine, with long, very white hairs and, covered with the densest and most felt-like hair coat that I have ever seen on any plant and the white "frailejon," a species of *Culcitium*, another genus of the sunflower family. All plants of the paramo must withstand cold, and accordingly we find developed various interesting means of protection. A wooly coat of hairs is the simplest. A low growth along the ground is a frequent adaptation, many plants growing in wide cushions from which only leaves or short flower shoots ascend an inch, or a fraction of an inch, into the air. A species of lupine grew matted on the ground; but denser colonies were formed by an alpine plantain and by certain Composites and Monocotyledons. One of the last, growing at the edge of pools in the valley's head, forms rounded coralline cushions of almost rock-like hardness and with outline as precise as any pattern. Although its short leaves projected vertically and one walked on the leaf-tips, these were so rigid and strong that no impress from the human foot could be detected.

We collected as full a series as possible of these alpine plants, and it is believed that by combining the result of this visit with that of the previous visit to Ruiz, our herbaria have now a fair repre-

sentation of the paramo life of the northern central Andes. We were unable to give as much time as we had hoped to the flora of the temperate forest just beneath this, but here again the two expeditions supplement each other.

On our descent from the Quindio in late August, Dr. Hazen had to return promptly to New York for his college work. Mr. Killip being desirous of collecting again at La Cumbre, in order to obtain many orchids seen by us in May only in leaf, accompanied Dr. Hazen to that convenient and attractive center.

With a capable peon, and with a reduced outfit of four cargo mules, I visited first Manizales, the seat of government for the Department of Caldas. From this city we proceeded directly westward to the high portion of the Western Andes which is a landmark from very far. The chain seems to rise suddenly to form a flat table, actually the short but high ridge of the Cerro Tatama. Although from the Cauca valley and from Santuario the highland appears wooded to the summit, I had reliable information that the upper slopes would be true paramo.

I was most hospitably received at Santuario, and I had no difficulty in arranging for a guide to the paramo. There was danger of oncoming rains, although as yet the weather was good. So I arranged to make a quick journey to the mountain paramos, allowing two days there. From a previous experience, when I had climbed to the Paramo de Chaquiro, one of the northernmost summits of the Western Andes, discovering it to be a paramo with a uniform and rather meagre flora, I believed that two days would allow sufficient time. Beside the danger of the September rains I was influenced by the reported difficulty of carrying up provisions for any stay of length.

So with two helpers I started into the forest from the cottage of Sr. Campia, situated in the subtropical forest on the lower slopes of the cordillera. My guide thought that we might be up in a day, and certainly in a day and another morning. We could see our goal, full before us in a dark-green line of cliffs, not twenty miles away. The "trail" proved to be only an old cut path over which no one had traveled for eighteen months! It was well that I had taken the best guide obtainable in the village. He had been over the way, but his mode of progress was not the northern guide's observation of landmarks. Rather, like a hound on the scent, he

progressed almost feeling his way, by hunting for old cuttings of the machete.

Our course lay first up a valley, following the guide's lead through a dense subtropical forest. Here there was no especial difficulty although progress was not swift. Then we reached a narrower part of the valley, and, after passing the night in an unfinished house in a small clearing,—the only sign of human occupation seen during our entire ascent,—we went on up along a turbulent mountain brook. So closely did we follow this stream's course that at times we made its very bed our route, and advanced by wading. We crossed its course in all twenty-five times, fording usually in the shallow formed by hard rocks at the head of rapids and waterfalls. At last we had to leave its course at a point where ahead we could see much higher waterfalls with no possibility of ascent.

From the river we went up the side of a valley so steep that it seemed to me impossible that the men could carry the loads. Slowly feeling our way, crossing logs and swinging upward by projecting tree-buttresses and roots, we could realize the amount of our advance. Every moment the view became wider and wilder. We passed just above the brink of a waterfall of unknown height; it was certainly great, but it was too perilous to attempt to reach any point with an adequate view below. Across the valley were two streams falling in sheer cascades, while ahead the chief stream of the valley could be traced through a succession of high waterfalls. We could look up to the cliffs now seeming quite near, but a uniform green still suggested only forest or shrubs to the highest point in sight.

We had meant to place our camp beside water in a little valley near paramo known to the guide. From the hillside forest we were working our way toward sundown along a spur, following the guide's amazing scent over and under the age-rotted logs and mossy tangles that I marked as the temperate virgin forest. But, alas, we came into a thicket of *Chusquea*, the dense growing bamboo that forms great tangles at this elevation. A bamboo grows rapidly and is liked by bears. The guide could find scarcely any old marks, and time after time his supposed cuttings proved on close inspection to be cut stalks broken by bears. Night came upon us here, and in the bamboo thicket, without water, we were forced to pitch our tent. We made what supper we could and hoped for quicker advance on

the morrow. That night, the eighth of the month, the first September rain fell,—a thunderstorm that chilled us on that high ridge.

The next morning we started at daybreak; but it proved a matter of over three hours to advance a few rods through that thicket. The cliffs ahead were too precipitous for us to assume that we could reach our goal by any but the known route. Now, within a mile or so we could see the cliffs,—an hour's clear progress would have brought us to them; yet it required hours of cutting through tangle, scrambling up cliffs, and feeling our way through virgin forest such as that of the previous day, to bring us at last, in the early afternoon, to the paramo.

After passing through a narrow belt of shrubs we came out on open grassy paramo, although still above us rose cliffs, deep-green with a coat of small trees and bushes. Indeed, I was not to reach the summit of these, and so to look beyond at the higher elevations of Tatamá. Lack of provisions, and the certainty of rain, meant our return on the morrow; and for this day the curtailing of our time on the paramo to two hours and a half. Perhaps, had the flora been so meagre as that of Chaquiro, even this little time might have sufficed, but on the paramo of Tatamá the flora proved exceedingly rich. Seldom have I found at such elevations a greater variety of plants; never a variety more interesting. Even photography had to be put aside in order to use every moment in gathering the plants before me.

From an advance survey it was natural to expect only slight difference in the kinds of plants growing upon isolated portions of the same chain as near together as are Chaquiro and Cerro Tatamá. Experience elsewhere had taught me to expect some divergence, but I was wholly unprepared for the great difference between the plant-life of these two summits. Except among plants with special means of dispersal by wind, I found little in common in the upper zones of life. Climbing to either highland one passes from the tropical forest into the subtropical forest, and these two lowest zones show little if any peculiarity in either region. The lower summits of the Western Andes and the passes over the chain lie no higher than the subtropical forest, and it is only above this level that the various portions of the cordillera are isolated. Climbing to Tatamá, there is an abrupt change from subtropical to temperate

forest. While the former possessed little that was novel, the latter yielded acquaintances new to me, in group after group. The same peculiarity and high proportion of novelty characterized the flora of the paramo. Although Cerro Tatamá has a cool zone flora, so much richer than that of Chaquiro, either upland possesses in equal sharpness of definition its own special world of life. Judging by the proportion of novelty in the groups of plants best known to the writer, most of the species existing there are yet unknown to man.

I saw on Tatamá open grassy slopes and rocky forested cliffs, while from a higher level there descended many waterfalls. Above, on the upper paramo, there must be much water,—a feature greatly in contrast with the waterless slopes of Chaquiro. My guide told of lakes and vast marshes, and of slopes covered with “*fraile-jones*.” Evidently there remains on the true summit of Cerro Tatamá a vast world of life yet unknown, and the temptation to climb to it when so near was most severe. I left the small edge of this paramo seen by me reluctantly indeed, and with the resolve that this mountain must be visited again, in a more favorable month, and with more preparation.

Great as must be the yet undiscovered treasures of Tatamá, they can scarcely prove more interesting than those still waiting for our collecting on other isolated areas of highlands of the northern western Cordillera, or which will be found in such areas throughout the Andean mountain system. A careful comparative study of the floras of these highland areas, isolated in space and in life from one another, will help us to understand past mountain connections and to fill out our knowledge of the geologic history of the Andes. In the course of its prosecution such a study will bring to knowledge the existence of many forms of life at present unsuspected.

With the collections from Tatamá, I returned through Medellín to the coast, and sailed for the United States from Cartagena on October 3rd. Mr. Killip arrived soon after, bringing with him his plants from La Cumbré. Other specimens had been brought home by Dr. Hazen, and still others had been shipped from Cali in July. All our specimens have arrived safely, and the total collection, of over 7000 numbers or about 23000 specimens, has been already apportioned to the institutions especially concerned in the exploration.

To those who aided us in Colombia, from the government which officially gave us every courtesy, to the many individuals

who gave us everywhere a generous welcome, our thanks are due. There is a genuine delight in working among the Colombians; in visiting such cities as Popayán; and in journeying through the Andean ranges. Needed as are now such expeditions for the scientific exploration of one of the most interesting parts of our earth, perhaps they may also serve the human goal of bringing about more personal relations between the United States and our Latin-American neighbors.

THROUGH CALIFORNIA TO THE MEXICAN BORDERLAND

BY JAMES A. G. REHN.

In continuance of the entomological field work conducted jointly by Mr. Morgan Hebard and the Academy of Natural Sciences of Philadelphia, the purposes and incentive of which were set forth in last year's ANNUAL REPORT, Mr. Hebard and the writer, during the summer of 1922, made a reconnoissance of certain of the mountains of the Great Basin, and of parts of California and Arizona, securing about 9000 specimens of Orthoptera, and some hundreds of other insects.

After some preliminary work in Wyoming, supplementing studies of previous years, I met my associate at Ogden, Utah, on the morning of August 16, and travelled to Wells, Nevada, where we had collected in 1919, and with a delightful ranch house in Clover Valley as a base, and two horses as means of transportation, we began our examination of the Ruby Mountains. These are the highest mountains in Nevada, their extreme point being about twelve thousand feet above sea-level, their serrated crests and the slopes for a thousand or so feet down showing many areas of snow at this late date. The exceptionally severe winter of 1921-22 over all this portion of the Great Basin and northwest made a very heavy snowfall, which was still in evidence in many places. To the west of Winchell's Ranch, in Clover Valley, towered the Ruby Range; eastward stretched the vast hayfields of the valley, and beyond, purple ridge after ridge, the Pequop and Toano Ranges, with the distant summit of Pilot Peak crowning all between, and holding the

light of the setting sun long after the valley about us had turned steel-blue with the shadows of twilight.

The mountains of the Great Basin are quite different in character from those of the Rockies system, in topography and geological history, being generally tilted fault blocks with virtually no foothills, the valleys between in many sections old lake basins, arms of the great Pleistocene lakes Bonneville and Lahontan, the shrunken present-day remnants of which are Great Salt, Utah, Pyramid, Winnemucca and Malheur Lakes, Carson Sink, and a number of other spectral, yet often strikingly beautiful, desert bodies of water. The plant and animal life of the higher life zones found on these Basin ranges shows marked differences from similar zones in the Rockies and the Sierras, as for instance the complete absence of great forests of fir in the Canadian zone, a regular feature in the other regions. The desire to secure information on the Orthoptera of these higher levels was the incentive urging us to examine these elevations in the Ruby Range.

Our base in Clover Valley was at six thousand feet and we worked upward through sage, and then across broad areas of chaparral and equally bad aspen thickets. At ninety-five hundred feet, as far as horses could go, we reached snow banks,—extensive areas hundreds of feet long, filling entire small valley bottoms and sending streams of ice-cold water to the thirsty valley below. Timber extended but little above the ten thousand foot point, where many alpine flowers were in bloom, the purple lupine being everywhere. Marmots whistled all about us, the alpine chipmunks nearly twisted off their tails in gyrations born of sheer curiosity, and at ten thousand eight hundred feet, two splendid Golden Eagles were seen. Storms hung all about us, and one drenched us thoroughly before we reached Clover Valley.

From Wells we travelled by rail to Westwood, passing alongside of the intensely blue waters of Pyramid Lake, on which, like bunches of cotton, the sedate White Pelicans rode the swells, or flew close to the water in that indescribably ponderous, yet wonderfully controlled flight common to all their kind. Dusty flats stretch from Pyramid Lake to the shallow waters of Honey Lake, from which our train followed up the course of the Susan River, on the trail of the early pioneers, through historic Susanville, then up and up into the magnificent Sierran forest of yellow and sugar pine, incense cedar and firs of several species.

With Westwood, an extensive lumber town, as a base, we made a trip to the country southeast of Mount Lassen, through miles of splendid forest which has never known the axe of the lumberman, up to Juniper Lake, seventy-eight hundred feet, a Sierran gem surrounded by pointed firs, which lies at the foot of Mount Harkness. We examined Mt. Harkness from base to summit, over lava of all sizes, and glacial moraines as well, the upper slopes being above timber line and furnishing arctic alpine conditions. Some grasshoppers which we had found at similar elevations on Mt. Shasta were there to greet us, and from the summit, far off to the north, the snow mantled bulk of that splendid mountain itself overhung like a great cloud. To the west, Mt. Lassen dominated the landscape, its snow-streaked and eviscerated summit showing the effect of the recent eruption; at our feet lay the deep blue waters of Juniper Lake, while in every direction were peaks and knobs of lesser elevation, covered with heavy forest.

Leaving Westwood by automobile, we passed down the Susan Valley, past Honey Lake to the dusty saline flats at the little settlement of Amedee. The Susan Valley has great hay and alfalfa fields, the sloughs of which harbored large numbers of wild ducks. As we neared Honey Lake the ground became more and more alkaline, the dust thicker and more pungent, while the sage of the Sierran foothills gave way to the Great Basin greasewood (*Sarcobatus*). Amedee has as its sole attraction a group of hot springs, one of which is a small geyser, gushing every forty-five seconds to a height of fifteen to eighteen inches and lasting fifteen to twenty seconds. Honey Lake, which we examined at closer range next day, was inhabited by thousands of ducks, feeding in the shallows. With them were small groups of beautiful avocets, while sandpipers and kildeer ran along the shores. A ride of nine hours on a narrow-gauge railroad from Amedee, brought us to Alturas, in extreme northeastern California.

Alturas is an historic spot, as it figured prominently in the "Modoc War", and to the north and west of it stretches for many miles the great Modoc lava region. The Pitt River, a tributary of the Sacramento which works through the Sierran-Cascade axis, here meanders through a broad valley flanked by the eight hundred foot escarpment of the lava sheet. The scattered cover on the lava is made up very largely of juniper, while much of the valley



UPPER.—EAST FACE OF THE RUBY MOUNTAINS, NEVADA, FROM ABOUT 8000 FEET ELEVATION.

LOWER.—SINK OF PANAMINT VALLEY, CALIFORNIA. ARGUS RANGE IN THE DISTANCE.

bottoms is in hay fields. East of Alturas, the Warner Range extends for a number of miles in Oregon and California, a north and south Great Basin range, east of which is Surprise Valley, a Basin plain with three sink lakes. The Warner Mountains in California culminate in Warren Peak, in elevation ninety-three hundred feet, some miles southeast of Alturas, while Cedar Peak, eighty-four hundred feet, is sixteen miles to the east of that town. With our limited time we decided to study Cedar Peak, and this rugged eminence, the upper slopes of which were very steep, composed of loose decomposed rock between jutting and chimney-like pinnacles of volcanic material, furnished us with a very hard day's work, to which much heavy manzanita chaparral added its detaining hand. From the summit, to the west, Shasta, over eighty miles away, hung in the sky in a most uncanny manner, while to the east Surprise Valley yawned beneath; to the northwest beautiful Goose Lake extended away into the distance. On the summit we found the Rock Wren, while a bunch of Clark's Crows showed the distinctly boreal character of the region. Just below the summit we took one of the prizes of the trip, a wonderfully colored flightless katydid, this specimen being unique in all our collections.

From the Alturas region to the Tonopah district of Nevada is a far cry, but a desire to compare the latter region with Nevadan districts to the north, west and south, impelled us to visit it en route. The immediate Tonopah neighborhood was of considerable interest, giving us much desired information on certain species concerning which very little was known. At Millers, fourteen miles to the west, we found the more austral Nevadan element well indicated. Some of the species here taken were difficult to secure, and almost certain to escape the casual collector. One of these was a flightless, clumsy, yet most interesting katydid, and to study it, in 1919, we spent two days and two nights in locating and securing six specimens, the enabling clue being the finding of several dead specimens in one of the plants frequented by the species.

After a brief stop at Berkeley and San Francisco, we resumed work at Coalinga, California, in the southwestern section of the great interior valley, an arid region bounded on the west by the yellow hills of the Diablo Range. The open floor of the valley, with its scanty cover of yellow sun-cured grass, held some desired species, while the friendly interest of several Roadrunners assured us we were reaching more southern climes.

At Priest Valley, in the nearby mountains, we were across the divide of the range and on one of the upper tributaries of the Salinas River, which flows into Monterey Bay. The chamise or solid stand of the Chamiso bush (*Adenostoma*) was all about us on the hill slopes; we attacked it with avidity, as quite a few interesting Orthoptera are known to inhabit this shrub. Chamise beating is not pleasant work, as the dry hills and the bushes are very dusty, these having small readily detached needle-like leaves and fuzzy seed capsules. To push one's way through heavy dense chamise is as unpleasant as beating work in the same environment, but we can forgive the bush its peculiarities for the interesting and little-known Orthoptera which we have found living upon it. On the open hill slopes about Priest Valley, the tar weed was much in evidence and soon reduced our beating nets to stiff and rubbery sacks. These mountains were in the past the homeland of the California Condor, but it is now a very rare bird in these parts, as is true of most parts of the state where it formerly ranged. The bushy-tailed ground squirrels (*Ammospermophilus*) were exceedingly abundant everywhere within the hills, while the strikingly marked California Woodpecker was in evidence wherever timber was present.

From Coalinga we moved on to Bakersfield, at the southern end of the San Joaquin Valley.

Mt. Pinos, the highest peak in the southern portion of the Coast Range, or more properly, the Ventura Mountains, was visited from Bakersfield. We following the splendid highway across a portion of the San Joaquin Valley floor, then up into the mountains, winding among the wonderful oaks of Tejon Canyon to Lebec, and, leaving highways behind, due west into a region of high forested ridges and beautiful valleys. The little settlement at Downey's Ranch afforded us a base, close to Mt. Pinos, and here we did some very profitable work. The good-hearted old ranch proprietor might have stepped from one of Bret Harte's stories, representative, as he was, of the vanishing California pioneer, having had, among other things, followed Yuba Bill's profession of stage-driver, and at over seventy was still active and vigorous, just as keen a deer hunter as anyone. Northwest of the ranch lay Mt. Pinos, but a few miles away, and reaching an elevation of eight thousand eight hundred feet. An old logging road gave relatively easy access to the upper slopes, winding around the main peak itself

through forests of splendid bull pine, which reached to the summit, although the higher ravines sheltered firs, frequently of very large size. The view from Mt. Pinos was wonderful, particularly to the southeast, in which direction, although many miles away, the high peaks of the San Bernardino and San Jacinto ranges dominated the landscape.

On our return trip to Bakersfield, shortly before reaching Lebec, in a broad canyon wash, we secured series of certain of the scarcest genera of Orthoptera known from this portion of California.

Trona, on Searles Lake, was our next stop; here is the plant of the American Trona Corporation, which extracts borax, salt, potash and trona from the Searles Lake deposits. The manager of the plant was most courteous and splendid quarters were assigned to us. Here every possible arrangement seems to have been made to make life comfortable, or at least endurable, in a desert region which is exceedingly hot during much of the year. Trona was to be the base from which we hoped to reach Panamint Valley and the higher Panamint Mountains. We secured an automobile and a driver, Dickinson, who cheerfully and whole heartedly took a personal interest in our work and helped to the limit of his ability. For nearly two weeks he accompanied us in the Panamint region, and then from San Diego across to the Imperial Valley.

Panamint Valley, the great western counterpart of Death Valley, is a wonderful prospect, stretching off to the north a great distance, limited on the west by the Argus Range, dominated by Maturango Peak, on the east walled by the massive barrier of the Panamint Range, with Telescope Peak crowning all. The Panamints appear very lofty from the west, but they do not give the over-powering impression they create upon the observer on the floor of Death Valley at the foot of their eastern cliffs. This can be understood when it is realized that from the east they tower more than a thousand feet higher from the basal sink than they do on the west, the floor of Death Valley being so much lower.

The sink of Panamint Valley is an extensive mud saline, hardly more than a thousand feet above sea level, and the road crossing is frequently very bad. Fortunately for us we had no difficulty, although it had been very soft but a few days previous. A melancholy and unusual object was noticed here in the shape of a mired

burro, which had bogged down to its belly and perished in an upright position, the mummied corpse a grim warning of the relentless grip of the mud of a playa sink.

Huddled at the foot of the Panamint Range, just across the mud flat, and on the road which was at one time the stage road from Mojave to the now deserted mining towns of Harrisburg and Skidoo, stand the disintegrating remains of Ballarat, once a flourishing mining center and distributing point. Now its former prestige a memory, all of its permanent inhabitants gone, and but a few transient ones left, Ballarat is another of those pathetic relics of the days when gold was the great lure to the grub-stakers of thirty years ago. Like the old-time prospector Ballarat is passing, but its well of good water is a splendid asset even to-day.

North from Ballarat we travelled along the east side of Panamint Valley to the mouth of Wild Rose Canyon, which we had planned to ascend as far as we could drive our powerful machine. The mouth of Wild Rose Canyon is entered only after traversing several miles of very bad "wash," largely broken rocks, and close under-cut banks of consolidated clays and gravels a hundred feet or so high. Travelling in such places is always bad, differing only in degree, always in danger of broken springs, axles, or engine damage, on account of the roughness of the so-called road and irregularity of the strain. In addition, during the summer period of rains the bed of a wash is the natural drainage of storm water which may fall miles away, and these channels become roaring torrents almost without warning.

At three thousand six hundred feet in Wild Rose Canyon is Wild Rose Spring, a trickle of delicious water which replenished all our water cans, and for many years had served prospectors and the Skidoo stage with their necessary supply. Quite a tangle of vegetation marks the course of this little rill down the canyon, until the thirsty earth takes back its own. At five thousand feet the canyon broadened out into a bowl-like enlargement some miles across, its floor seamed with washes and low ridges, the way usually being up one of the former. The first junipers and pinyons were encountered at about six thousand feet, and then the narrowing canyon and the nearness of the main ridge ahead told us we were approaching our destination. At nearly seven thousand feet, like gigantic stone beehives, stand the old charcoal kilns, used in days

gone by for preparing fuel for smelting ore. Here we camped for several days and it proved a splendid base from which we examined the surrounding ridges and the summits of Mt. Baldy and Telescope Peak.

A relatively short climb from the kilns brought us, quite abruptly, to a low saddle in the main ridge of the Panamints, where from eighty-five hundred feet elevation we could look over the wonderful color display of Death Valley, spread out nearly nine thousand feet below. The white salines and the dunes of the burning "bottom of the bowl" were brush dabs of a titanic artist; the Amargosa Range across Death Valley showed all of its weird outline and wonderful color stripings, while far beyond, but as sharply defined as though but a dozen miles away, rose the massive bulk of the Charleston or Spring Mountain Range, about one hundred miles to the east. It was the most stupendous panorama it has been my good fortune to see, and the view from but few places in the world can equal it in sheer impressiveness and grandeur of proportions. The haze of Death Valley, that intangible veil which the furnace-like depression casts over its own impressive sterility, imparted tones of changing color to the chasm below, while the sinuous salt beds seemed now like rivers of chalky white, and again like ribbons of shining silver. Swinging the eyes from the abysmal depths to the east and looking westward, our view was almost as remarkable. Range after range—the Argus, the Coso, the Inyo—succeeded one another, their intervening valleys showing steel-blue in the light of late afternoon, while the horizon itself was formed by the snow caps of the great Sierras, with Mt. Whitney the monarch of the ridge and the highest point in the United States, clearly evident. The highest and lowest points of our land were in sight on the turn of a heel.

The ascent of Telescope Peak, eleven thousand three hundred feet in elevation, was made by Mr. Hebard and Dickinson. A few timber-line pines crept to the summit, but no distinctive arctic-alpine grasshoppers, such as occur in the Sierras, were found. This is quite in accord with our observations on other high desert ranges in California and Nevada.

The nights at our camp by the kilns in Wild Rose Canyon were cold and keeping warm was the main problem. The sky at night was generally overcast and rain was expected daily. We were fortunate, however, in this respect, but a heavy storm followed us

down the canyon, and crossed Panamint Valley after we had safely reached Ballarat on our return trip. The crusted hummocky saline mud and areas of the salt-loving plant *Salicornia* near here occupied our attention, and yielded a grasshopper which was known to frequent similar saline areas in Death Valley. As we climbed the steep grade of the pass into Searles Valley we could see the storm which had trailed us, sweeping across Panamint Valley, blowing the dust before it in a great sheet-like smoke, and throwing it far up on the eastern face of the Argus Range, while over Maturango Peak another storm raged. Trona seemed quite homelike and we spent another day in that vicinity, on the flat and in the lower canyons of the Argus Range. From Trona we went to Los Angeles, and then to San Diego to start the next section of our work.

Tia Juana, the few houses on the American side of the Mexican Boundary, was the major objective the first day of our San Diego-Imperial Valley cross-section. The famous, or perhaps better infamous, town in Mexico bears the variant name of Tijuana, but it is separated from the smaller American community by the generally dry bed of the Tia Juana River. Good-sized hills, covered with a chamise-like bush, several other shrubs and a few cacti and yucca, roll off to the eastward. The plant cover of these hills yielded one of the best finds of the summer, a katydid of which an immature specimen was in our collections, but of which the adult was previously unknown; both sexes in the adult condition were taken by us at Tia Juana. The dry wash of the Tia Juana River, the country about Chulavista and the sand dunes and salt marshes near Coronado Beach were also examined. One of the scarcest California grasshoppers was taken at Chulavista, and two most desirable species, one originally described from that locality, were taken in the Coronado environments.

Heading east from San Diego, we entered a region of good-sized hills which passed into true mountains, some very rugged and broken. We worked at Jamul and Dulzura, where, at a thousand feet above the sea, oaks began to be more in evidence. Steadily climbing over low divides, and then dropping down into other valleys, we reached the belt of chamise (*Adenostoma*) at Potrero, two thousand five hundred feet elevation. Here and at Campo, some eight miles to the east, in charming country which reminds one somewhat of eastern landscapes, profitable stops were made.

To the north of Campo a score of miles or so is Cuyamaca Peak, the highest elevation between the San Jacinto Range and the Mexican line, reaching over six thousand five hundred feet above sea level. It was one of our objectives, and from Campo we headed in that direction, through beautiful broken country with fine oaks and some pine, interspersed with meadowy areas. Guatey (pronounced "Wah-tíe") and Descanso were good collecting stations, and a summer camp near the latter place afforded excellent night accommodations. Cuyamaca Peak lay but a few miles away, and an old wood road soon placed us at the foot of the east slope of the peak. The forest cover was quite heavy,—below splendid oak, then pine with much cedar, and finally near the top some fir (*Abies*). The upper slopes were quite steep, in some places at least forty-five degree inclines. The summit bears a forest rangers' fire station, and the view from this well repays one for the climb. To the north, San Jacinto and San Gorgonio Peaks were clearly evident, and to the northwest could be seen Santiago Peak in the Santa Ana Range, although the Laguna Range to the east hid the Salton Sea and the Imperial Valley from view. The Lagunas were our next objective and we spent some hours travelling the narrow, sinuous, rocky and distinctly dangerous grade which leads into this high plateau of jumbled ridges, standing guard over the yawning desert to the east. Here a little tent camp among the whispering pines, which cover much of the Lagunas, afforded a good base.

From the eastern escarpment of the Lagunas, with its cover of scrub oak, chamise and manzanita (a productive locality for us), one's view extended far to the east over the distant Salton Sea and a portion of the Imperial Valley. The slopes below the viewpoint were very abrupt, resembling in a general way, although on a smaller scale, the eastern face of the Panamint Range above Death Valley. Just a short distance below the rim of the escarpment we could see pinyon, a tree unnoticed on the coastward or San Diegan side of these mountains. Here the contact of two markedly different life areas was evident,—the San Diegan to the west and that called the Western Desert Tract to the east. The insect life, as well as the plant forms, amply support the evidence which has been secured from the vertebrates, regarding the line of contact of these two life areas in the territory from the San Jacinto Range southward.

Retracing our way to Campo, our journey was resumed parallel to and but a short distance north of the Mexican line. East of Campo the surface became more broken and rolling, with curious hills bearing erosion resistant capping stones, showing the original plateau character of the land. Jacumba Hot Springs is but a few miles west of Wagon Pass, from which the road starts the long descent to the scorching flats of the Imperial Valley. Certain of the characteristic desert plants, as creosote bush (*Covillea*), reach up tributary valleys of Carriso Creek to within less than two miles of Jacumba Hot Springs, the immediate vicinity of which is not at all like the Colorado Desert-Imperial Valley in its plant cover. About Wagon Pass numerous yuccas and cacti proclaimed the advent of more desert types. Certain grasshoppers of the Colorado Desert region, whose acquaintance we had made in past years, were in evidence at both of these localities, showing that elevation is not the essential factor controlling their distribution.

From Jacumba Hot Springs, with its cool evenings, and Wagon Pass with its elevation of three thousand seven hundred feet, our route lay steadily down hill, with a regularly mounting temperature, through the few houses at Mountain Springs, then some miles of very rugged canyon—almost a gorge in fact—past Coyote Wells, and out on the floor of the intensely hot Imperial Valley.

The Imperial Valley is but a portion of the great Colorado Desert, although the advent of irrigation, by means of canals from the Colorado River, has made possible the cultivation of a considerable portion of the lower levels of the region. Now we have thriving communities where twenty-five years ago the unredeemed desert held sway. The story of these canals, and of the destruction of their head-gates which caused the refilling of the Salton Sink, needs no retelling here. The deep gorge-like channels in the valley silt, through which the Colorado hurled its flood, are sufficiently impressive to show how the Salton came to be a "sea" again, repeating past history, as its ancient shore-lines testify.

So much of the Imperial Valley is now under cultivation that it is exceedingly difficult to find any untouched country of easy access from its bustling communities, and we soon travelled northward toward the Salton Sea and the primeval waste of the Colorado Desert. El Centro (fifty feet below sea level) and the other Imperial Valley towns were then enduring a shade temperature of 114°,



UPPER.—FAN PALMS (NEOWASHINGTONIA) OF THE COLORADO DESERT. IN THE FOOTHILLS OF THE SAN BERNARDINO MOUNTAINS, NORTH OF INDIO, CALIFORNIA.

LOWER.—JUNIPER LAKE, MOUNT LASSEN SECTION OF THE SIERRAS, CALIFORNIA.

which was said to be quite high for September, added to which was the oppressiveness found in depressions below sea level. The summer heat has proved too great for some of the earlier settlers, and the use of Mexican and negro labor seems to be largely responsible for the agricultural success of the region.

We had one particular reason for visiting the Imperial Valley and spending more time in the Colorado Desert—to search for a very rare genus of grasshoppers previously known only from two specimens. Search in past years in the Colorado Desert, and in the Imperial Valley itself, so far had failed to reveal this remarkable insect. Kane Spring is a little desert water-hole passed after leaving the settled region, and some six miles northwest of this landmark we examined a group of absolutely bare yellow sandhills surrounded by silt and sand flats, with some areas of gravel surface covering. Here to our joy we took a most satisfactory series of the long-sought grasshopper, and were able to make most interesting and novel observations on its habits and actions.

For forty miles along the west side of the Salton Sea there is no trace of human habitations, but a splendid concrete road connects the Imperial Valley with the Los Angeles territory, and makes possible in relative comfort the study of this very desolate country. The Salton Sea stretches off to the east in the glory of its spectral blue—a desert lake which it is hard to convince oneself is not a mirage. The influence of this body of water, which has appreciably contracted in the past ten years, produces a most pleasing cool breeze, the loss of which is manifest very shortly after leaving the “Sea” behind. A short trip was made into one of the canyons of the foothills of the San Bernardino Range near Indio, where the native desert fan palm (*Neowashingtonia*) grows. This palm is the host plant of the gigantic bostrychid boring beetle *Dinapate wrighti*, to the attacks of which the splendid tree eventually succumbs, although the insect itself is very difficult to locate and secure. The original specimens of *Dinapate* are treasured possessions of the collections at the Academy, and the genus and species were first described by the late Dr. George H. Horn, long a distinguished officer and member of the institution.

Bidding California good-bye, a night train took us from Indio to Gila, Arizona. The sun came up in a pink glory, the desert mountains going from pink to purplish, then into their day colors

in that indescribable way which Arizona holds as her own. A forty-four mile railroad, which uses a motor bus on the rails for passengers, extends south from Gila (pronounced "Heé-la") to Ajo ("Ah'-ho"), a large and modern copper-mining community. The conspicuous vegetation of the country traversed is typical of southwestern Arizona, including such species as palo verde, palo fierro, cat claw, mesquite, sahuaro and cholla, excepting the first all decidedly spined or hooked and so to be respected. To the southeast Gunsight Mountain and Montezuma's Head in the Big Ajo Range came into view, while Crater Mountain was passed on the right. Far off to the west, among the multitude of other peaks and ridges, Castle Dome, about eighty miles away, was clearly evident.

The town of Ajo is in the Little Ajo Mountains, and work in these and in the grassy Ajo Valley, about six miles away, was wonderfully productive for us. The vegetation of these mountains is nearly an optimum development of the Arizona desert flora, particularly in the arborescent forms. The great pitahaya or candelabra cactus (*Cereus thurberi*) here reaches its northern limit. One of our particularly desirable finds was a fair series of both sexes of a genus and species of grasshopper known before from the United States by only a single damaged specimen.

A trip was made from Ajo to Quitobaquito, a little Papago Indian community, directly on the Mexican line and nearly forty miles south of Ajo. Our route took us through the Growler Range and down Growler Valley to the Quitobaquita Hills, the elevations all with the really fine desert vegetation seen about Ajo. Much rain had blessed this portion of Arizona, and the washes had waist-high patches of vividly green galleta grass. Quitobaquita has a good spring, several houses and a few inhabitants, and it is one of the little communities along the Rio Sonoyta, a desert river of precarious existence on the Mexican side of the line. The town has an unenviable reputation for heat, which was fully maintained the day we were there.

From Ajo we moved several hundred miles to Nogales, Arizona, about seventy miles south of Tucson. Nogales was our center for some days, and from it we examined the Pajaritos Mountains to the west, the Patagonia Mountains to the east, and some rolling country and the bottom lands of the Santa Cruz River to the north.

The Pajaritos were our most productive section in the Nogales region. They are a jumbled group of relatively high jagged peaks and pinnacles, as well as many lower ridges, largely covered with oak groves, and as a whole an extremely interesting and diversified territory to study. Our most striking results were a genus of grasshoppers previously unknown from north of central Mexico, and the previously unsecured adults of one of our rarest and most imperfectly known genera of the same family, while numerous other very desirable species were secured.

The Patagonia Mountains were not as interesting as the Pajaritos, although we examined a number of environments, extending to the highest levels. The range is by no means as broken as the Pajaritos, with more long grassy stretches on the south-facing slopes, and the oak cover more restricted to the north-facing slopes. The localities examined nearer Nogales were quite productive—grassy slopes, mesquite flats and groves of huge cottonwoods along the river bottom.

From Nogales we moved eastward, following the boundary line quite closely, working at Fairbanks, Naco, Osborn, Douglas and San Bernardino Ranch, all in Arizona. From Naco we made a side trip to Don Luis, at the foot of the Mule Mountains, then through the copper town of Bisbee to Mule Pass in the same mountains. From Mule Pass we climbed to two nearby summits, reaching about seven thousand two hundred feet elevation. At Don Luis we found a foot hill element in the Orthoptera which was absent from the flat at Naco, although weakly indicated in the limestone hills at Osborn about six miles away. The higher Mule Mountains were not markedly productive or interesting to us, probably because the range is not high enough to carry boreal conditions, yet the upper slopes are too cold for more typically south Arizonan types.

The name of San Bernardino Ranch is a familiar one in distributional entomology, as Prof. Snow of the University of Kansas spent most of a summer there some fifteen years ago, and his collections made at that locality have been studied by many students. Our visit was made to secure additional information and material, and we were very successful. San Bernardino Ranch lies over twenty miles east of Douglas, across the low Perilla Mountains, and at the lowest level, in the United States, of the San

Bernardino Valley, which drains southward into the basin of the Rio Yaqui of Mexico and is separated from the San Simon Valley to the north by low hills. A portion of the ranch property is in Mexico, and its extensive areas of sacaton grass were very profitable collecting grounds. The rough surface of the nearby "bench," with a covering of lava fragments, was of equal interest to us.

From Douglas we moved eastward to our last collecting district at Hachita, New Mexico. From Hachita we made a short trip to the Hachita Grande Mountains, about thirty miles by the route followed. In Playas Valley at the west foot of the range, we found an area of black brush (*Flourensia cernua*), which yielded important material, while a pull from this point of a thousand feet higher, to five thousand five hundred feet elevation, placed us in a broad canyon relatively close to the towering Hachita Peak itself. Mr. Hebard worked through the juniper and pinyon belt to a point above which sheer cliffs made the main peak inaccessible from the west side. The canyon floor and the nearby juniper and pinyon-clad slopes yielded many forms of interest. This same range had been examined a number of years ago by Dr. Pilsbry of the Academy, who, in his search for land mollusks, ascended the peak from the east.

Leaving Hachita the evening of September 27, a brief stop to repack material was made at El Paso, and on the morning of October 1st, we reached Philadelphia, after a most profitable and interesting, as well as enjoyable, trip.

THE ACADEMY'S DEPARTMENT OF BIRDS

BY WITMER STONE.

The visitor to a large museum such as that of the Academy sees only the specimens which are displayed in the exhibition halls. Formerly all specimens were so displayed and persons unfamiliar with modern museum methods still have the idea that these exhibits include all of the museum's collections. This, however, is by no means the case and the specimens on exhibition often constitute a comparatively insignificant portion of the museum's resources.



A SERIES OF MOTH-PROOF METAL BIRD CASES IN THE
ORNITHOLOGICAL STUDY ROOM.



A CASE OPENED TO SHOW ARRANGEMENT OF
SKINS IN DRAWERS

It seems desirable to make this fact clear both to our members and visitors and to explain the extent, relationship and objects of the several collections in each department, so that a clearer conception of our needs and resources may be obtained, and in this year's report we propose to consider the department of birds, as being perhaps best calculated to illustrate the subject.

When a corps of specialists in the various branches of natural history took the place of the single museum curator of old, their duties were not only the supervision of the exhibits in their respective departments, but also the prosecution of original research. This necessitated the acquisition of many more specimens than the two or three of each kind which formed the mounted collection in the exhibition hall. There must be specimens showing variation due to sex, age, season and environment. Furthermore, the specimens must be of a character suitable for easy handling, and comparison. Thus was developed the skin collection, a bird "skin" being a stuffed specimen, resembling a dead bird lying on its back with its wings close to the body, but without the glass eyes, wires, etc., characteristic of the mounted specimen. The wings, feet, bill and feathers of such a specimen may be examined with ease which is not possible with a mounted bird, and if the need arises a skin may be relaxed by steaming and can be mounted if desired.

The museum's "study collection" of skins is very much larger than the exhibition collection of mounted birds, for several reasons. As already stated a series of specimens is required for the research work being carried on in the department, far larger than the number needed for exhibition; then again many closely allied forms which would not be distinguished by the average visitor are preserved only in the study collection and so also with most of the very rare or historic specimens. The reason for this is a very important one, namely that the colors of bird plumage are seriously affected by light, and a mounted specimen even though not exposed to direct sunlight will inevitably fade and is soon useless for scientific study. The extent of fading varies in different species, and many specimens that have become useless for technical research, retain their colors sufficiently well to serve as exhibits for many years.

It should be clear to anyone, however, that the only reliable, permanent collection of birds is the study collection of skins. It can be constantly added to and brought nearer and nearer to com-

pletion, while the exhibition collection is ever deteriorating and has to be replenished, much as a collection of live birds in a zoological garden, or an aviary, which suffer the loss of specimens by death almost as fast as they receive new accessions.

The study collection should be regarded in the same light as a scientific reference library, where rare old volumes are preserved for centuries and carefully guarded against deterioration. And how are our study collections of bird skins preserved? In metal cases fitted with clamped doors, which render them dustproof, lightproof, and mothproof, the specimens being arranged in shallow drawers, and labelled with tags bearing information relative to the date and place of capture, sex, age, etc.

The chief aim of the Academy's ornithological department today is to secure for the study collection specimens of such birds as are not now represented, so that they may be preserved for examination and study by future ornithologists when, and at no distant time, many of them will be unobtainable. This need is urgent and immediate and we should be enabled to secure important desiderata by purchase whenever opportunity offers.

Up to 1888, the Academy's collection of birds was almost entirely mounted, some 25,000 specimens mounted on T-perches being displayed on shelves where they stood, rank upon rank, so crowded that only a few were visible. Since then about three-quarters of these specimens, including the historic types of early authors and large numbers of duplicates have been reduced to skins, while some 40,000 modern "skins" have been secured by expeditions, purchase, and gift.

The old collection was largely the private collection of Dr. Thomas B. Wilson which included the Rivoli (Massena) Collection, the Gould Collection of Australian birds, and many smaller collections purchased in London and Paris from 1845 to 1855. There were also many specimens obtained on the early government expeditions received in exchange with the National Museum; specimens obtained in the west by Townsend, Gambel, Heerman and Woodhouse. This collection was largely assembled during the period of John Cassin's activity, and its value was vastly enhanced by the years of study that he spent upon it. From the time of his death in 1869 until 1888, when the writer assumed charge of the collections, practically no accessions were made, but from that time they have been many.

Explorations have been carried on, wholly or in part ornithological, from which the collections have come to the Academy, as follows:

- 1890. Yucatan and Southern Mexico (W. Stone and F. C. Baker).
- 1890-91. Bahamas and Jamaica (J. P. Moore).
- 1891. Florida, Texas, and Arizona (S. N. Rhoads).
- 1891-2. Greenland (W. E. Hughes and Langdon Gibson).
- 1892. British Columbia and Washington (S. N. Rhoads).
- 1894-95. Somaliland (A. Donaldson Smith).
- 1895. Aleutian Islands (Benjamin Sharp).
- 1897. Borneo (A. C. Harrison, Jr., W. H. Furness).
- 1897. Sumatra and outlying Islands (Van der Pol Colln).
- 1897. Manchuria (A. D. Smith, Geo. L. Farnum).
- 1897. California (A. S. Bunnell).
- 1897-98. Alaska (E. A. McIlhenny).
- 1901. Chihuahua, Mex. (W. E. Hughes).
- 1902. New Mexico (H. L. Viereck and J. A. G. Rehn).
- 1904. British East Africa (Geo. L. Harrison, Jr.).
- 1905. Lower California (S. N. Rhoads).
- 1907. Philippines (E. H. Porter).
- 1910-16. Colombia (M. A. Carriker, Jr.).
- 1910-13. Panama (L. L. Jewell).
- 1911. Venezuela (F. E. Bond, T. S. Gillen and S. Brown).
- 1911. Ecuador (S. N. Rhoads).
- 1911. Philippines (Jos. Clemens).
- 1911-12. Cameroon (G. L. Bates).
- 1915. Guatemala (S. N. Rhoads, E. L. Poole).
- 1919. Chiricahua Mts., Arizona (W. Stone).
- 1922. Nicaragua (Wharton Huber and J. Fletcher Street).

Several large collections covering many countries have also been received:

W. L. Abbott (by gift) a collection covering, Cuba, San Domingo, N. Dakota, Iowa, Pennsylvania, and New Jersey.

Canon Tristram (by purchase), a collection covering the world, especially rich in island forms.

Josiah Hoopes (by gift and purchase), a very complete North American collection.

And many smaller North American and foreign collections.

With the development of the research collection it must not be thought that the exhibition collections are neglected. Many freshly-mounted specimens have been presented and others prepared in our taxidermical shop to replenish the exhibits.

A nearly complete local collection is now displayed, mainly through the coöperation of the Delaware Valley Ornithological Club; and a seasonal exhibit is arranged to show the sequence of arrival of migrants in Spring, both of which are constantly consulted by local bird students. As an adjunct to these a local collection of skins of Pennsylvania and New Jersey birds is kept separate from the main series for the use of more advanced local students.

Future aims are to arrange the exhibits into faunal and systematic series, and to add groups illustrating life histories, and special phases of bird life, as fast as means are available.

It should thus be clear that two lines of activity are being constantly maintained. (1) The preservation of our historic, scientific, research collection, with the idea of making it as nearly complete as possible and to further technical ornithological study. (2) The maintenance of exhibition collections which shall be as instructive as possible, and yet not involve the deterioration of specimens whose scientific value demands their most careful preservation.

Report on the Museum
ADMINISTRATION OF THE MUSEUM
BOARD OF CURATORS.

WITMER STONE, *Executive Curator*. HENRY A. PILSBRY, *Secretary*.
T. CHALKLEY PALMER, GEORGE L. HARRISON, JR.

SCIENTIFIC STAFF.

Vertebrate Zoology.

WITMER STONE, *Special Curator*.
WHARTON HUBER, *Assistant Curator, Birds and Mammals*.
HENRY W. FOWLER, *Assistant Curator, Fishes and Reptiles*.

Mollusca and other Marine Invertebrates.

HENRY A. PILSBRY, *Special Curator*.
EDWARD G. VANATTA, *Assistant Curator*.

Insects.

HENRY SKINNER, *Special Curator*.
JAMES A. G. REHN, *Assistant Curator*.
E. T. CRESSON, JR., *Assistant Curator*.
MORGAN HEBARD, *Research Associate*.
ROSWELL C. WILLIAMS, JR., *Research Associate*.

Plants.

FRANCIS W. PENNELL, *Special Curator*.
BAYARD LONG, *Research Associate*.

Minerals and Rocks.

FRANK J. KEELEY, *Curator of the William S. Vaux Collections*.
SAMUEL G. GORDON, *Assistant Curator, in charge of the General Collection*.

Archeology.

MISS H. NEWELL WARDLE, *Assistant Curator, in charge*.

Ludwick Department of Public Instruction.

HAROLD T. GREEN, *in charge*.

Taxidermist.

DAVID McCADDEN.

The Museum halls have been open as usual to the public during the year and have been visited by large numbers of persons, especially classes of school children from the city and nearby suburbs.

Through the coöperation of the Ludwick Institute, the services of Mr. Harold T. Green have been available throughout the past year, and besides managing the Ludwick lecture courses, he has accomplished much in increasing the educational value of the museum exhibits and in general publicity work, thereby making known the activities of the Academy both in the field and in the museum.

Several important exhibits have been prepared during the year, notably a series of casts of the reptiles and batrachians of Pennsylvania and New Jersey, which will soon be placed in special cases with descriptive labels to supplement the collections of local birds and crustaceans already on exhibit, the intention being to eventually provide as complete a series as possible illustrative of the zoology of the vicinity of Philadelphia.

A special exhibit which has been in preparation and will be displayed in the near future, is a group of Bald Eagles, the nest, with the tree top in which it was located, having been secured for the Academy by Mr. Arthur H. Fisher, from the shores of Chesapeake Bay.

Entomological exhibits illustrating the life-history of the destructive Japanese Beetle and the harmless Chinese Mantis, both recently introduced into this vicinity and at present attracting much popular interest, have been prepared by Mr. Green.

The seasonal collection of mounted birds was again displayed during the Spring months to show just what species may be looked for every week in the neighborhood of Philadelphia as the migration advances, and attracted much interest, as did the similar exhibit of pressed wild flowers.

The scientific staff has been fully occupied with the care and study of the research collections, and much important progress has been made, details of which are given in the reports of the several departments.

The Academy has been particularly fortunate in the amount of field-work which it has been able to carry on during the year.

Messrs. Wharton Huber and J. Fletcher Street visited Nicaragua in the interests of the institution, and secured valuable collections especially of birds, mammals and insects. The travelling expenses of this expedition to Bluefields and back were generously subscribed by members of the Academy; and during their stay in the country the members were the guests of Dr. Theodore E. Bouchell and the officers of the Tonopah Mining Company, who did everything in their power to aid them in carrying on their work. Mr. J. A. G. Rehn was enabled to join Mr. Morgan Hebard in another reconnaissance of parts of California and Arizona for the collecting of Orthoptera, the Academy sharing with Mr. Hebard in the material obtained. Dr. H. A. Pilsbry spent three months (September to November) in the eastern ranges of New Mexico and the Big Bend region of Texas, collecting mollusca in the San Andraes, Organ, Sierra Blanca, New Mexico, and the Guadalupe and Chisos ranges of Texas. The object of this trip was to map the eastern limits of the characteristic desert groups. Mr. Rehn's and Dr. Pilsbry's expenses were provided for by members of the Academy.

Dr. Francis W. Pennell, coöperating with the N. Y. Botanical Garden, the Gray Herbarium, and the U. S. National Museum, headed an expedition to the Colombian Andes for the purpose of continuing his botanical researches in the region, and secured some 23000 specimens, which the Academy shares equally with the other institutions, in return for Dr. Pennell's services. He had as his field associates Mr. E. P. Killip, of Washington and Dr. T. L. Hazen, of Columbia University.

Mr. Henry W. Fowler, in the same way, is securing for the Museum a very valuable series of Pacific fishes in return for determining the collections in the Bishop Museum in Honolulu, his expenses being covered by the award of a Yale University Pacific scholarship. He left on August 1, and will return in April of next year, spending some time in collecting desirable material on the coast of California.

Realizing the imperative need for additional cases for housing the study collections in various departments, and funds to carry on several of the expeditions just described, the Curators were authorized by the Council to endeavor to raise funds for the purpose, and thanks to the generosity of our members, a sum of over \$5000

was subscribed, with which cases for insects, plants and birds, were procured, sufficient to care for the accessions of recent years, and two exhibition cases for the Archeological Department.

Details of the work in the several departments follow.

MAMMALS

Many interesting specimens were received from the Zoological Society of Philadelphia, including a Snow Leopard, which has been mounted and placed in the exhibition series.

A collection of 60 Nicaraguan mammals was obtained by the Academy expedition, among which is a series of Mantled Howler Monkeys,—males, females and young. Many skeletons have been prepared for the study collection, and a large number of skulls, cleaned.

Specimens have been loaned during the year to the U. S. Biological Survey and H. E. Anthony.

BIRDS

The absence of Mr. Huber in the field, and illness of Dr. Stone, seriously interfered with extended work on the research collections, but accessions have been cared for, and many of the cases have been more fully labelled to facilitate consultation of specimens. Mr. Huber, since his return, has been engaged upon the identification of the Nicaraguan collection which numbers 625 specimens including many species not hitherto represented in the Academy's series.

Other notable accessions during the year have been a selection of the most interesting specimens from the collection of the late George Spencer Morris, comprising local material and a series of skins from Puget Sound; the entire collection of skins of Dr. William E. Hughes, comprising many formerly in the collection of John Krider, as well as recent series from Maine, the New Jersey coast, etc.

Material has been loaned during the year to Dr. F. M. Chapman, W. E. Clyde Todd, James P. Chapin, and others.

REPTILES AND BATRACHIANS

Many specimens have been obtained by the staff and correspondents from which casts of 36 local species have been prepared by Mr.

McCadden, the taxidermist, and Mr. Green of the Ludwick Department of Public Instruction, and it is hoped to complete this exhibit next year.

Mr. Fowler, before leaving for Honolulu, cared for all accessions received up to that time, including many obtained by the Nicaragua expedition.

A specimen was loaned to Mr. E. R. Dunn.

FISHES

Mr. H. W. Fowler reports that the examination of the study collection was completed before he left for Honolulu, and the jars replenished with alcohol, wherever necessary.

All of the specimens from Oceania were studied and determined in connection with this proposed work at the Bishop Museum; and reports prepared on collections sent from the American Museum of Natural History; Messrs. Marley and Robinson, Natal, South Africa; and James Hornell, Esq., of the Madras Fisheries Department, India, from all of which the Academy received duplicates.

Three papers were prepared for publication by the Academy: On Freshwater Fishes from the Southern Alleghanies; On Fishes received from Madeira, Madagascar, Syria, and Australia; Fishes from Nicaragua.

INSECTS

Dr. Skinner, Special Curator of Insects, reports that upwards of 9000 specimens have been added to the collections during the year, not including several thousand obtained by the Academy-Nicaraguan expedition. Miss Caroline H. Lane, whose services were secured at the beginning of the year, has been engaged in mounting the accumulation of unstudied material, and has made much progress, while many of the specimens have been named and incorporated in the collections.

The valuable collection of Odonata made by Dr. P. P. Calvert, probably the finest in America, has been presented to the Academy, bringing our representation of dragon-flies, etc., into the very first rank.

Dr. Skinner and Mr. R. C. Williams, Jr., have paid especial attention to the Lepidoptera and have published a paper on the male genitalia of the larger Hesperidae of North America.

The collection of Diptera is steadily growing and has been under the care of Mr. E. T. Cresson, Jr. More than 275 specimens have been received from various sources, including 115 specimens of 60 species, mostly from South America and East Indies, containing many paratypes. The family Borboridae has been studied by an authority and contains over 525 specimens and 75 species, of which many are to be described as new. A large collection of the family Micropezidae, mostly from South America and the East Indies, has been studied by Mr. Cresson, among which many new species were found and will shortly be described. The material retained will increase the Academy's collection in this family about 75 per cent. Much time has been given to the material sent in for determination, which, in most cases, has been added to the collection. The Diptera collected by the Academy expeditions are being studied and reports on these are in preparation. Mr. Cresson has also labeled and numbered the Bassett types of the hymenopterous family Cynipidae. Of the 125 species described by Mr. Bassett, the collection contains all but two. The following papers have been prepared by Mr. Cresson in the course of his studies of the collection and published, or are in press: Studies in American Ephydriidae; Descriptions of New Genera and Species of Ephydriidae; and, The Bassett Types of Cynipidae.

In the Orthoptera, Messrs, Rehn and Hebard have continued the rearrangement of the exotic series, almost the entire series of Tettigoniidae having been handled and large series of recently determined material interpolated. Similar work has been accomplished upon a large part of the exotic Acrididae.

Mr. Rehn has made an extensive study of the Blattidae of the West Indies, and upon certain genera of North American Acrididae. Progress has been made upon several papers on African Orthoptera, which have been under way for some years. An important collection, made in the Amazonian region of Brazil and Peru, has been received for study from the Royal Swedish Natural History Museum, a representation of the material to remain at the Academy in return for its study.

Mr. Hebard has completed studies of three genera of North American Acrididae, and has continued his studies of Panamanian and Colombian Orthoptera into the families Mantidae, Phasmidae and Acrididae. A second most important collection of Guianan Blat-

tidae has been partially studied by him, and very satisfactory arrangements made with the Paris Museum for the retention of a large part of the series. Very important exchanges with the British Museum of Natural History have been negotiated by him, which added numerous genera to our collections. He has secured by purchase, and otherwise, important collections of Orthoptera from Peru, Venezuela, Bolivia, Katanga in the Belgian Congo, British India, Philippines and China.

Papers published during the year by Mr. Rehn are: Descriptions of New and Critical Notes upon Previously known Forms of North American Oedipodinae. Paper II. (In: Trans. A. E. S., 27 pp. 2 pls.) Studies in Costa Rican Dermaptera and Orthoptera. Paper I. (In: Trans. A. E. S., 12 pp. 1 pl.) Contributions to our Knowledge of the Dermaptera and Orthoptera of the Transvaal and Natal. Part I. Dermaptera and Blattidae. (In: Annals of the Transvaal Museum. 99 pp. 4 pls.)

By Morgan Hebard: Mexican Records of Blattidae. (In: Trans. A. E. S., 22 pp. 1 pl.) South American Blattidae from the Muséum National d'Histoire Naturelle, Paris, France. (In: Proc. Acad. Nat. Sci. Phila., 112 pp. 7 pls.) The Janeirensis Group of the Genus Euborellia, etc. (In: Trans. A. E. S., 6 pp. 2 pls.) The Dermaptera and Orthoptera of Hawaii. (In: Occas. Papers Bernice Pauahi Bishop Mus., 72 pp. 2 pls.) New Genera and Species of Melanopli found within the United States and Canada. Part IV. (In: Trans. A. E. S., 28 pp. 2 pls.) Notes on a Few Interesting Blattidae from Guatemala, with the Description of a New Species. (In: Trans. A. E. S., 4 pp.) North American Acrididae. Papers I, II. (In: Trans. A. E. S., 20 pp. 1 pl.)

Many entomologists have consulted the collections during the year, and much assistance has been given local students and school children in the identification of specimens.

Specimens were loaned to B. Uvarov, and Morgan Hebard.

PLANTS

During the early part of the year there was prepared a complete inventory of the collections of the Academy on hand and as yet unmounted. For the general herbarium over thirty collections from various sources have been mounted during the year, representing a total of over 6000 specimens. We have vast collections

not yet in the herbarium; and the mounting of the rich herbaria of Mr. C. W. Short, one of the chief private American herbaria of the past century; of Prof. T. C. Porter, for many years the most prominent student of Pennsylvania plants; and of several others, is much to be desired.

The housing of the Herbarium in metal dust-proof and insect-proof cases has just been completed. The mounted collection is now, excepting a portion of the local herbarium, safely cared for.

The rearranging of the general herbarium for the purpose of facilitating rapid geographical reference has enlisted a number of volunteer assistants, especially Dr. Henry Leffman, and Miss Alice O. Albertson, to whom our thanks are due.

During the college year of 1921-22, we were fortunate in having the assistance of Mr. John M. Fogg, Jr., a student of the University of Pennsylvania, who rendered invaluable assistance and took general care of the department during Dr. Pennell's absence in South America.

Research study in the herbarium has been much aided by the addition to our equipment of a modern binocular microscope, but owing to absence on field-work, Dr. Pennell has accomplished little new study during the year. The study of the Scrophulariaceae of the central Rocky Mountain States has been nearly completed; and notes prepared dealing with the species of this family in the Santa Catalina Islands, California, and of the genus *Pentstemon* in Indiana. A paper on the Scrophulariaceae of the west Gulf States has been published in the PROCEEDINGS of the Academy.

From April 25 until October 18, Dr. Pennell was engaged in botanical collecting and exploration in the northern Andes of Colombia, as already explained; and besides the work of collecting, special field work was done in the study of the Andean Scrophulariaceae, and in the distribution of the plant life of the high cordilleras.

The local herbarium continues under the efficient care of Mr. Bayard Long. Work has progressed in the geographical sorting of the specimens, and the collection is second to none in its preservation and arrangement. New metal cases, have permitted a much needed expansion. Since February, Mr. George W. Bassett has been employed in mounting specimens. This enables us to add Mr. Long's very extensive personal collections, which consist of valuable and unusually beautiful specimens.

Specimens were loaned to C. A. Weatherly, K. K. McKenzie, H. St. John, and E. B. Payson.

MOLLUSKS

Accessions were received from 73 persons and institutions.

In the *Manual of Conchology* the account of Orculinae, a subfamily of Pupillidae, has been prepared and partly published.

In collaboration with Mr. Ferriss, the Special Curator has prepared a paper dealing with the distribution and anatomy of land-shells of central Arizona.

Mr. Vanatta has been chiefly employed in identifying specimens for correspondents, in preparing new material, and in working over and selecting specimens from several general collections received.

About 888 specimens have been loaned for study to twelve investigators in other institutions.

MINERALS

Mr. Samuel G. Gordon has continued in charge of the collection in this department. During the past year his time was largely spent in crystallographic investigation of minerals secured on the Vaux-Academy Andean Expedition of 1921, and at Franklin, N. J.

Mr. Gordon spent part of the summer of 1922, visiting the feldspar, mica and corundum mines of southwestern North Carolina; and shorter trips were made during the fall to Franklin, N. J., and Branchville, and Middletown, in Connecticut.

The most notable accession of the year was the collection of the late William H. Shaw, presented by his son, Charles K. Shaw. The collection is particularly rich in fine amethysts, garnets, beryls and feldspars from Delaware County, although it is by no means limited to local minerals.

Other accessions are noted in the report of the Curator of the William S. Vaux Collections.

ARCHEOLOGY

The Department of Archeology has continued under the care of Miss H. Newell Wardle.

During the year 1922, donations amounting to 567 specimens were received, exclusive of Mr. Clarence B. Moore's addition to his collections. Some of the objects received are extremely rare.

Changes have been made in the arrangement of the department, to create an Egyptian section, which, besides being of never-failing interest to the public, gives promise of growth in the near future. The African and West Indian exhibits have also been rearranged; and a special display of Malaysian objects are shown in the case for temporary exhibits.

Mr. John L. Baer, of the U. S. National Museum, made a study of the Academy's series of "banner stones," in connection with a forth-coming monograph.

No papers were published during the year, but study was continued upon the stone ceremonials of the eastern United States, which will be published as soon as the illustrations are completed.

At the request of the Camden County Historical Society, Miss Wardle classified and arranged the archeological collection of that institution.

REPORT OF THE CURATOR OF THE WILLIAM S. VAUX COLLECTIONS.

During the past year, 47 specimens were purchased in addition to series of minerals from Franklin, N. J., and Langban, Sweden.

Noteworthy among these are lead and inesite crystals from Langban, Sweden; strengite, Pleystein, Bavaria; dipotase, Otavi, Africa; and tephroite crystals, Franklin, N. J.

Among species new to the collection, the Vaux-Academy 1921 Andean Expedition yielded the following,—vauxite, paravauxite, keeleyite, daubresite, sphaerite and rhomboclasite, of which the first three are new species, described during the year by Mr. Samuel G. Gordon.

Other minerals not hitherto represented in the collection, include ferrierite, presented by Dr. W. F. Ferrier; haidingerite, invoite, hulsite and orientite, obtained by exchange; and the following, which were purchased: miersite, xanthoxenite, otavite, thortveitite, phosphosiderite, barthite, phosphoferrite, phosphophyllite, ectripite, kezekite, catoptrite, dixenite, curite and kasolite.

The excellent condition of the collection continues to be due principally to the assiduous efforts of Mr. Gordon.

Respectfully submitted

F. J. KEELEY,

Curator, William S. Vaux Collections.

ADDITIONS TO THE MUSEUM

1922

MAMMALS

ACADEMY NICARAGUAN EXPEDITION. 60 specimens of mammals

T. W. ANTHONY. Porpoise skull, Barnegat, N. J.

SAMUEL G. GORDON. Cat skin, Bolivia.

H. P. JAMES. 2 Squirrel skins, Nicaragua.

DR. W. W. KEEN. Several small mammals mounted.

JAMES S. MCKENZIE. Skin and skull of Opossum and Otter, Nicaragua.

HOWARD A. PERKINS. Mounted Moose head. (*Alces americanus*), Ontario, Can.

PHILADELPHIA ZOOLOGICAL SOCIETY. Skin and skull of Porcupine; Wombat (*Phascolomys ursinus*); Snow Leopard (*Felis uncia.*); Manatee skeleton, Florida.

BIRDS

DR. WM. L. ABBOTT. Jacana skins (*Jacana violacea*), San Domingo.

ACADEMY EXPEDITION TO NICARAGUA. Collection of 625 bird skins.

MRS. JOHN A. BROWN. Thirteen mounted Birds.

PURCHASED. Collection of bird skins, Bolivia.

MRS. I. S. FISHBLATT. Two Old Squaw Ducks (*Harelda hyemalis*), Atlantic City, N. J.

RICHARD B. FREEMAN. Collection of bird eggs.

MRS. E. T. GILL. Little Auk (*Alle alle*), Beach Haven, N. J.

DR. WILLIAM E. HUGHES. Collection of bird skins, Pennsylvania, New Jersey and Maine.

MRS. WALTER JACKSON FREEMAN. Collection of bird eggs.

F. GUY MEYERS. Two Red Shoulder Hawks (*Buteo lineatus*); Four Red-tailed Hawks (*Buteo borealis*), Llanerch, Pa.

GEORGE SPENCER MORRIS EST. Collection of bird skins, Pennsylvania, New Jersey and Washington.

DAVID McCADDEN. Barn Owl (*Tyto pratincola*), Pennsylvania.

T. STORDY. Young Night Hawk (*Chordeiles virginianus*), Philadelphia.

DR. T. SEYDEL VACA. Three Parrots (*Amazona albifrons*, *Aratinga canicularis*, *Brotogerys jugularis*), Nicaragua.

AMPHIBIANS AND REPTILES

ACADEMY EXPEDITION TO NICARAGUA. Two jars of Reptiles.

WILLIAM J. FOX. Mud Turtle (*Kinosternon pennsylvanicum*), Bowers, Delaware.

DAVID McCADDEN. Garter Snake (*Thamnophis sirtalis*), Pennsylvania; Two Tree Toads (*Hyla versicolor*), Pennsylvania.

JAMES A. G. REHN. Horned Toad (*Phrynosoma regale*), Arizona.

JAMES L. SHOCH. Wood Turtle (*Clemmys insculpta*); Box Turtle (*Didicla carolina*); Muhlenberg's Turtle, (*Clemmys muhlenbergii*); Black Snake (*Bascanion constrictor*), Quakertown, Pa.

J. B. TOWNSEND, JR. Rattlesnake (*Crotalus horridus*), Pennsylvania.

GUSTAV WEBER. One Red-bellied Snake (*Storeria occipito-maculata*), New Jersey.

R. W. WEHRLE. Queen Water Snake (*Regina leberis*), Pennsylvania; Sticky Salamander (*Plethodon glutinosus*); Ring-necked Snake (*Diadophis punctatus*); House Snake (*Lampropeltis doliiatus clericus*); Grass Snake (*Liopeltis vernalis*); Box Turtle (*Didicla carolina*); two Snapping Turtles (*Chelydra serpentina*); one jar Salamanders; two Purple Salamanders (*Gyrinophilus porphyriticus*); one Pilot Black Snake (*Elaphe obsoletus*).

CHESTER WERNER. Red-bellied Turtle (*Pseudemys rubiventris*), New Jersey

FISHES

ACADEMY EXPEDITION TO NICARAGUA. Two jars of Fishes.

AMERICAN MUSEUM OF NATURAL HISTORY. Sixty-seven fresh-water fish, E. Mongolia, China. (Duplicate set, collected by Third Asiatic Expedition.)

HENRY W. FOWLER. Five jars fresh-water fish, Virginia.

JAMES HORNELL. Gobioid fish, Madras, India.

M. B. HUSTON. Gar pike *Lepisosteus tropicus*, Nicaragua.

DR. ADOLFO CESAR DE NORONHA. Collection of fishes, thirty-three species, Maderia Islands.

PEDRO SERIE (Purchased). Collection of fishes, Argentina.

WISTAR INSTITUTE OF ANATOMY. Two collections of fishes, British North Borneo.

INSECTS

DR. W. L. ABBOTT. Four insects, San Domingo.

ACADEMY EXPEDITION TO NICARAGUA. Collection of several thousand insects.

R. R. ALLEN. Four insects, Maine.

M. BEZZI. Fifteen Diptera, Africa and South America.

F. E. BLAISDELL. One hundred and eighty-two Coleoptera, California.

DR. THEODORE BOUCHELLE. Fifteen Orthoptera, Nicaragua; one hundred and fifty Insects, Nicaragua.

E. P. BUCKELL. Seven hundred and twenty-five Orthoptera, British Columbia, Canada.

DR. PHILIP P. CALVERT. Eight Odonata, United States; twenty-six insects, Central America and United States.

D. M. CASTLE. Seven Hymenoptera, Hawaiian Islands.

A. N. CAUDELL. One Zoraptera, Hawaii.

B. P. CLARKE. *Ornithoptera urvilliana*, Solomon Islands.

T. D. A. COCKERELL. Twenty-one Insects.

K. R. COOLIDGE. Sixty Lepidoptera, California.

W. J. COXEY. Two *Chelepterix collesi*, Australia. *Attacus dohertyi*, Tenimber Islands.

WM. T. DAVIS. *Tibicen robinsoni*, Virginia.

C. W. DRAKE. Twenty-five Hemiptera, United States.

H. C. FALL. Sixty-two *Gyrinus*, United States.

T. H. FRISON. Ten Hymenoptera, United States.

HEBARD-ACADEMY EXPEDITION OF 1922. Collection of 4500 Orthoptera, Western United States.

M. HEBARD. Two hundred and seventy-six Lepidoptera, Western United States; three Moths, Wyoming; forty-four Coleoptera, India.

DR. WM. E. HUGHES. Two hundred and ten insects, Fiji and Samoa.

F. M. JONES. Collection of insects, Mississippi, Florida, Arizona.

PHILIP LAURENT. Five moths, Florida; eleven Diptera, Florida.

R. A. LEUSSLER. Twenty-five Hesperidae, Nebraska.

DR. VICTOR A. LOEB. Six hundred and sixteen moths, Pennsylvania and New Jersey; 81 Hymenoptera, United States; 96 Diptera, United States.

WM. M. MANN (Exchange). Twenty-six exotic ants.

F. R. MASON. Moth, Tennessee.

DR. LEVI W. MENGEL. Butterfly, Ecuador.

JAS. MCFARLAND, JR. Two Coleoptera, South America.

J. S. MCKENZIE. Four boxes entomological specimens, Nicaragua.

H. A. PILSBRY. One hundred insects, Texas, New Mexico.

PURCHASED. Three hundred Lepidoptera, Paraguay; 143 Hesperidae, Honduras; 207 Hesperidae, Paraguay. Collection of Orthoptera, Fukien, China.

C. T. RAMSDEN. Seven *Terias*, Cuba.

DR. H. SKINNER. Two hundred and eighty Lepidoptera, Panama.

E. M. SWAINSON. Nineteen Hesperidae, Jamaica.

M. C. VAN DUZEE. Twenty-three Diptera, United States.

A. B. WALCOTT. Two Coleoptera, Michigan.

H. W. WENZEL. Sixty-three *Donacia*, Pennsylvania and New Jersey.

F. X. WILLIAMS. Seventeen Hymenoptera, Hawaii.

R. C. WILLIAMS, JR. Twenty-one Lepidoptera, Arizona; 6 Exotic Hesperidae, French Guiana; 18 Hesperidae, United States.

RECENT MOLLUSCA

DR. W. L. ABBOTT. *Polygyra albolabris* Say, from Henry Valley, Pennsylvania.

W. O. ABBOTT. Two shells from High Point, New Jersey.

A. REGINALD ALLEN. Eight species of shells from Maine and New Hampshire.

DR. FRED BAKER. Three land shells from Brazil.

GEORGE W. BASSETT. *Sphaerium occidentale* Prime, from Hammonton, New Jersey.

BERNICE PAUAHI BISHOP MUSEUM. One hundred and seven trays of Hawaiian land shells.

DR. S. S. BERRY. Thirteen trays of land shells from California.

S. C. BISHOP. Two species of fresh-water shells from Isle au Haute, Maine.

LOUIS H. BREGY. *Goniobasis nigrina* Lea, from Union Gap, Yakima Valley, Washington.

- JAMES B. CLARK. Seventy-five trays of shells from Western America.
- H. C. CLAUSEN. Twelve trays of Japanese shells.
- T. D. A. COCKERELL. *Geomitra arenicola* Lowe, from east of Canical, Madeira.
- MAJ. M. CONNOLLY. *Nothapalus ugandanus* Conn. (part of the original lot).
- C. M. COOKE, JR. Five trays of land shells from Vancouver Island.
- S. G. CRAMP. *Quadrula schoolcraftensis* Lea, from Pittsford, New York.
- PROF. W. H. DALL. *Æsopus chrysalloideus* Cpr., from San Pedro, California.
- JAMES M. DELANEY. *Anodontoides ferrussaciana* Lea. from the Erie Canal at Rochester, New York.
- EPISCOPAL ACADEMY. Two land shells from the South Pacific.
- MISS E. W. EVANS. Two species of marine shells from Camden, Maine.
- JOHN FARQUHAR. Two species of *Fauxulus*.
- J. H. FERRISS. Two hundred trays of land shells from Arizona.
- J. M. FOGG. Five trays of shells from New Jersey.
- H. W. FOWLER. Two species of fresh-water shells.
- MRS. WALTER J. FREEMAN. A collection of marine shells.
- M. GIBSON. A collection of marine shells.
- C. GOODRICH. Forty-six trays of fresh-water shells from the Mississippi Valley.
- G. D. HANNA (exchange). Seven trays of land shells from California.
- GEO. L. HARRISON, JR. *Polygyra albolabris* Say, from Thomasville, North Carolina.
- MORGAN HEBARD. Three land shells from New Mexico.
- JUNIUS HENDERSON. *Oreohelix depressa* Ckll., from Hardscrapple Draw, Arizona.
- MRS. H. S. HOPPER. Five species of marine shells.
- WHARTON HUBER. Six trays of shells from Nicaragua.
- DR. W. E. HUGHES. Eight trays of land shells from the Fiji and Samoa Islands.
- INDIAN MUSEUM. Three species of Pupillidae.
- E. A. JEFFRIES. A pearl from *Ostrea elongata* Sol., collected at Chincoteague, Virginia.
- F. J. KEELEY. Two species of bivalves from Florida.
- D. C. LEFFERTS. *Physa humerosa* Gld., from twenty miles south of Indio, California.
- BAYARD LONG. Seventy-five trays of shells from Nova Scotia and New Jersey.
- H. N. LOWE. Forty-one trays of shells from California and Utah.
- D. N. MCCADDEN. Three marine shells from the crop of *Marila affinis*.
- J. G. MALONE. One hundred and sixty-eight trays of shells.
- D. P. MANNIX. *Caecum glabrum* Mont., from Bermuda.
- B. C. MARSHALL. *Philomycus carolinensis* Bosc., from Lawrence County, Arkansas.
- DR. H. B. MEREDITH. Four species of shells from Virginia.
- J. P. MIDDLETON. Eighteen species of marine shells from West America.
- J. B. O. MOCKRIDGE. *Patella vulgata* L., from Lizard Head, England.
- CLARENCE B. MOORE. Sixty-four trays of land shells from Florida.

- L. MOWBRY. *Polypus rugosa* Bosc., from Florida.
- T. C. NELSON. *Teredo novangliae* Bart., from Barnegat Bay, New Jersey.
- N. H. ODHNER (exchange). Nineteen trays of land shells from Juan Fernandez and Easter Island.
- MRS. I. S. OLDROYD. *Pupilla blandi* Mse., from Logan, Utah.
- A. A. OLSSON. Ninety-nine species of marine shells from near Havana, Cuba.
- LT. COL. A. J. PEILE. Radula of *Marconia margarita* Prest., from Uganda, Africa.
- H. A. PILSBRY. Two hundred and twelve trays of shells from New York and Hawaiian Islands.
- PURCHASED. Forty-four trays of land and fresh water shells.
- J. A. G. REHN AND M. HEBARD. Five trays of shells from California.
- SENCKENBERGISCHES MUSEUM (exchange). Sixty-eight trays of *Pupillidae*.
- MRS. HELEN STOKES. Collection of marine shells.
- D. THAANUM. Twenty-two trays of shells from Japan and the Hawaiian Islands.
- U. S. NATIONAL MUSEUM. *Sonorella hachitana* Dall, from New Mexico.
- T. VAN HYNING. Thirty-nine trays of shells from Florida.
- G. VAN INGEN. *Polita alliacria* Mill., from Poughkeepsie, New York.
- PROF. A. E. VERRILL. *Neopetraeus atahualpa* Dohrn, from the Andes of Peru.
- DR. BRYANT WALKER. Six trays of land and fresh-water shells from Peru and Alabama.
- WARDS NATURAL SCIENCE ESTABLISHMENT. *Achatinella lehuiensis* Gul., from Waianae, Oahu Island.
- R. W. WEHRLE. *Polygyra profunda* Say, from Indiana, Pennsylvania.
- MISS E. L. WHITAKER. Collection of marine shells.
- R. C. WILLIAMS, JR. *Busycon perversa* L., from Corson's Inlet, New Jersey.
- WISTAR INSTITUTE. Forty-four trays of shells from Celebes and Borneo.
- J. ZETEK. One hundred and twenty-four trays of marine shells from Central America.

OTHER INVERTEBRATES

- BERNICE PAUAHI BISHOP MUSEUM. *Chthamalus hembeli* Conr., from Oahu Island.
- DR. PHILIP P. CALVERT. Collection of Myriapods and Arachnida, Costa Rica.
- J. B. CLARK. Two trays of *Mitella polymerus* Sby., from California.
- MRS. E. R. JONES. *Macrocheira kaempferi* De Hav., from Japan.
- JOSE LIENHART. Scorpion, Honduras.
- U. S. NATIONAL MUSEUM. Two barnacles from Uruguay.
- C. S. WURTS. One *Heliaster* from Nova Scotia.

FOSSILS

- JOSEPH MCFARLAND. Invertebrate fossils from New Jersey and Pennsylvania.
- H. A. PILSBRY. Two trays of invertebrate fossils from New York.
- BENJAMINE C. WARNICK. Mammoth Tusk, Alaska.

PLANTS

G. W. BASSETT. Five hundred specimens from New Jersey; also numerous specimens of cultivated plants.

W. M. BENNER. One hundred specimens, chiefly from Bucks County, Pennsylvania.

O. H. BROWN. One hundred specimens from Cape May County, New Jersey.

I. W. CLOKEY. Four hundred and fifty-five specimens from Colorado.

JOSEPH CRAWFORD. Specimens from New Jersey and Georgia.

MRS. S. W. CREASEY. Specimens of *Sonchus uliginosus*, from Bucks County Pennsylvania.

C. C. DEAM. Four hundred and forty-six specimens from Indiana.

R. R. DREISBACH. Two hundred and twenty specimens from Ohio and Michigan; also 100 specimens from New Jersey and Pennsylvania.

DR. J. W. ECKFELDT. *Callitriche austini*, from Bucks County, Pennsylvania.

MR. W. C. FERGUSON. Three specimens of *Sagittaria* and *Rynchospora*.

M. FOGG, JR. Eight hundred specimens, mostly from southern New Jersey.

DR. H. A. GLEASON. Four hundred specimens, collected by J. S. de la Cruz in British Guiana.

DR. A. A. JONES. Specimens of a cultivated *Solanum*.

A. N. LEEDS. *Caltha* from Pennsylvania; and *Prunus* from New Jersey.

MR. C. D. LIPPINCOTT. *Solidago erecta* from southwestern New Jersey.

BAYARD LONG. Two thousand specimens from Berks and Bucks Counties, Pennsylvania.

K. K. MACKENZIE. *Carex misandroides* from western Newfoundland.

DR. H. B. MEREDITH. Eight hundred specimens from New Jersey, Pennsylvania, and Delaware.

DR. J. C. NELSON. Two hundred specimens from western Oregon.

NEW YORK BOTANICAL GARDEN. Fifty-one specimens, collected by DR. L. Britton in Porto Rico.

REV. J. P. OTIS. Seven specimens from Delaware and Maryland.

T. C. PALMER. Various specimens from Chester County, Pennsylvania.

J. D. U. PLEASANTS. Six specimens from Pennsylvania.

E. A. RAU. Specimens of *Sonchus uliginosus* and *Sisymbrium altissimum*, from eastern Pennsylvania.

GEORGE REDLES. Twenty specimens from New Jersey and Pennsylvania.

LEE SOWDEN. One hundred specimens from Minnewaska, New York.

O. A. STEVENS. *Sonchus uliginosus*; and other new weeds from North Dakota.

DR. R. R. STEWART. Two hundred Scrophulariaceae from northern India.

DR. W. R. TAYLOR. Eight specimens chiefly from Massachusetts and New Brunswick.

MARY H. WILLIAMS. Many specimens from the eastern United States and Bermuda.

MINERALS

SEÑOR AUGUSTIN ARIAS. Collection Minerals, Cerro de Pasco, Peru.

W. R. FERRIER. Ferrierite.

MICHAEL J. CLANCEY. Gold, Nicaragua.

MRS. WALTER JACKSON FREEMAN. Collection of minerals.

F. LYNWOOD GARRISON. Minerals from China and Nevada.

MISS L. GIBSON. Collection of minerals.

DR. W. W. KEEN. Collection of minerals.

SEÑOR ADOLFO LAHAYG. Collection of minerals, Llallagua, Bolivia.

J. S. MALONE. Collection of Quartz and Agate pebbles from Oregon.

JOSEPH MCFARLAND, JR. Collection of rocks.

R. A. F. PENROSE, JR. Phosphatic concretion, Sampson Co., S. C.

CHARLES K. SHAW. Collection of minerals of Wm. H. Shaw.

MISS E. L. WHITAKER. Collection of minerals.

PURCHASED. Forty-seven minerals from Franklin, N. J., and Langban, Sweden.

EXCHANGE. Haidingerite, hulsite, ingoite and orientite.

ARCHEOLOGY

MISS GERTRUDE ABBOTT. Dancing-girl's anklet; Chumen-(lime) boxes; little girl's ornament, etc. Celebes.

DR. WM. L. ABBOTT. Natives' mats. Madagascar.

GEORGE W. BASSETT. Stone implements, Phila., Pa., and Cape May Co., N. J.

LYNFORD BIDDLE. Stone implements from "Red-paint graves," Mt. Desert, Me.

CHARLES S. BOYER. Celt, Island of Orchilla, W. I.

MICHAEL J. CLANCEY. Stone and pottery images, stone implements; Nicaragua. Bows, arrows, beadwork ornaments, mat, and bark-cloth blankets of Sumo Indians, Nicaragua.

MRS. WALTER JACKSON FREEMAN. Stone implements, Colorado; Clay figurine; Mexico; Ethnographical material from New Mexico, Alaska, Curacao, and Tunis; Archaeological material, Carthage.

A. W. GIMBE (in exchange). Arrowheads, Penn.

MISS M. L. HOPPER. Pueblo pottery; ancient sherds and flakes, New Mexico and Wyoming. Roman and Egyptian archeological material.

WHARTON HUBER. Celt, Nicaragua.

DR. W. W. KEEN. Stone implements, Eastern U. S., sherds, Arizona.

J. G. MALONE. Cowry clusters, Africa (?).

DR. JOHN MARSHALL. Tapa, Samoa.

I. P. MIDDLETON. Ancient Peruvian pottery; Roman lamps; shell bracelet, Indonesia; Woodpecker-feather head'bands, California. Etc.

CLARENCE B. MOORE. Archeological material from Florida Keys; printed reproductions of scenes from the Egyptian "Book of the Dead," and illustrations of Mummy-cases.

MISS M. D. POTT. Stone implements, Berks Co., Penn.

CALVERT PRATT. Stone implements, Del. Co., Penn., and Montana.

UNIVERSITY OF WASHINGTON, STATE MUSEUM (in exchange). Stone implements, Washington.

WISTAR INSTITUTE, UNIVERSITY OF PENNSYLVANIA. Upas poison, Celebes.

OTHER MATERIAL

ESTATE OF C. N. PIERCE. Dr. Pierce's microscope and collection of slides.

CHARLES K. SHAW. Refractometer.

SAMUEL G. GORDON. Two mercury-vapor arc lamps, and set of monochromatic filters.

The Ludwick Public Lectures

By its free public lectures the Academy brings nature and the great outdoors to many who have no opportunity to study them first hand. The courses, moreover, draw many visitors to the museum and serve to increase their interest in the exhibits.

The usual courses under the auspices of the Ludwick Institute were given during the winter and early spring months; and we were fortunate in securing the services of several prominent naturalists from other institutions to augment the Academy's staff. All of the lectures were illustrated by colored lantern slides, many of them showing the results of field work by Academy naturalists, and one was illustrated by motion pictures.

About 2600 persons attended the Monday evening course; 1700 the Sunday afternoon lectures; and 1900 the school lectures on Friday afternoon. A course was also provided on local natural history, especially for the Boy Scouts, but little advantage was taken of it.

The Sunday lectures were particularly appreciated and the attendance was large. The lecturers and topics were as follows:

MONDAY EVENINGS JANUARY 9—APRIL 24.

- "With the 'Albatross' in the Philippines," Dr. Paul Bartsch.
- "Wild Bird Life on Our New Jersey Coast," Dr. Witmer Stone.
- "Upland Fishes," Henry W. Fowler.
- "Wayside Blooms," J. Fletcher Street.
- "The Way of the Sperm Whaler," Dr. Robert Cushman Murphy.
- "Backboned Animals," Dr. Spencer Trotter.
- "Problems of Insect Life," James A. G. Rehn.
- "The Life of a Lake," Dr. Henry A. Pilsbry.
- "Cretaceous Dinosaurs," Dr. W. D. Matthew.
- "The Southern Alleghanies," Dr. Witmer Stone.
- "The Aristocrats of the Plant World," Dr. Francis W. Pennell.
- "Lowland Fishes," Henry W. Fowler.
- "Bees and Beekeeping," Dr. E. F. Phillips.
- "The Economic Aspect of Entomology," James A. G. Rehn.
- "The Domesticated Animals," Dr. Spencer Trotter.
- "Useful and Injurious Mollusks and Shells," Dr. Henry A. Pilsbry.

SUNDAY AFTERNOONS FEBRUARY 5—MARCH 26.

- "Some Days in Japan," Dr. William E. Hughes.
- "The Migration of Birds," Dr. Witmer Stone.
- "Rare, Strange and Beautiful Shells," Dr. Henry A. Pillsbry.
- "Radium, its Sources and a brief Summary of its Characteristics," F. Lynwood Garrison.
- "Southern Arizona," James A. G. Rehn.

"A Naturalist in the Santa Marta Region, Colombia," James A. G. Rehn.

"American Bird Types," Dr. Spencer Trotter.

"Natural History in American Zoos," Arthur H. Fisher. (Motion pictures.)

FRIDAY AFTERNOONS (SCHOOL COURSE ON LOCAL NATURAL HISTORY) MARCH 3—
MARCH 31

"Some Familiar Birds of the Philadelphia Area," Dr. Witmer Stone.

"Fish Life of the Brook," Henry W. Fowler.

"The Shell-life of our Woods, Streams, and Seashore," Dr. Henry A. Pilsbry.

"Some Insect Friends and Enemies of our Neighborhood," James A. G. Rehn.

"Spring Flowers," Dr. Francis W. Pennell.

REPORTS OF SECTIONS

REPORT OF THE BIOLOGICAL AND MICROSCOPICAL SECTION.—The Biological and Microscopical Section held nine meetings during the year.

In conjunction with the Mineralogical and Geological Section twenty-two excursions were made to localities in Pennsylvania and New Jersey, for purposes of collection, with an average attendance of fourteen members and their friends.

An innovation has been made in the publication of "Contributions from the Biological and Microscopical Section of the Academy of Natural Sciences of Philadelphia," and the first paper is entitled: "New Species of Diatoms," appearing in July.

The Conservator reports the gift to the Section by Mrs. F. H. Easby of the microscope and accessories of the late Dr. C. Newlin Pierce, including a Zentmayer Grand-American stand, numerous oculars and objectives and one hundred and fifty slides.

Communications were made by the following members: Messrs. T. Chalkley Palmer, Hugo Bilgram, F. J. Keeley, Dr. Thomas S. Stewart, Hugh Munro, W. A. Poyser, and Charles S. Boyer.

The following officers were elected for the year 1923:

<i>Director</i>	T. Chalkley Palmer
<i>Vice-Director</i>	John A. Shulze
<i>Recorder</i>	Charles S. Boyer
<i>Treasurer</i>	Thomas S. Stewart, M. D.
<i>Corresponding Secretary</i>	Walter Palmer
<i>Conservator</i>	F. J. Keeley

CHARLES S. BOYER,

Recorder.

ENTOMOLOGICAL SECTION.—The Entomological Section has held all of its stated meetings which have been fairly well attended. Interesting communications and exhibits have been made by several of the members, contributors and visitors. Messrs. John C.

Hollinger, R. H. Hutchison, Arthur D. Whedon, and Frank R. Mason, were elected members.

The following were elected to serve for 1923:

<i>Director</i>	Philip Laurent
<i>Vice-Director</i>	Roswell C. Williams
<i>Secretary</i>	James A. G. Rehn
<i>Treasurer</i>	Ezra T. Cresson
<i>Recorder</i>	Ezra T. Cresson, Jr.
<i>Conservator</i>	Henry Skinner.
<i>Publication Committee:</i> Ezra T. Cresson, Philip P. Calvert and Ezra T. Cresson, Jr.	

E. T. CRESSON, JR.

Recorder.

MINERALOGICAL AND GEOLOGICAL SECTION.—Weekly excursions during the Spring and Autumn months, jointly with the Biological and Microscopical Section, afforded opportunities for visiting most of the interesting geological localities in the neighborhood of Philadelphia.

At the annual meeting, the following officers were elected to serve during ensuing year:

<i>Director</i>	F. J. Keeley
<i>Vice-Director</i>	T. Chalkley Palmer
<i>Treasurer</i>	Thomas S. Stewart
<i>Conservator</i>	George Vaux, Jr.
<i>Recorder</i>	Samuel G. Gordon

F. J. KEELEY,

Director.

BOTANICAL SECTION.—At a meeting of the Botanical Section held in January last it was decided to dissolve the Section, as the care of the herbarium is so well looked after by the Academy, and the meetings of the Botanical Club fill all needs for furthering the study of local plants.

It is the wish of the Section that the income of the J. H. Redfield Memorial Fund, which now reverts absolutely to the Academy, be used for the purchase of botanical specimens, subject to the direction of the curators.

WITMER STONE,

Treasurer.

ORNITHOLOGICAL SECTION.—The Ornithological Section has encouraged the study of ornithology at the Academy in every way possible. The Delaware Valley Ornithological Club has continued to hold its meetings in the ornithological rooms completing thirty-two years of continued activity at the Academy.

The Pennsylvania Audubon Society and Fairmount Park Bird Club have also met in the lecture hall.

The officers elected for 1923 are:

<i>Director</i>	Spencer Trotter
<i>Vice-Director</i>	Samuel N. Rhoads
<i>Recorder</i>	Julian K. Potter
<i>Secretary</i>	William A. Shryock
<i>Treasurer and Recorder</i>	Witmer Stone.

WITMER STONE,

Recorder.

LIBRARY

ADMINISTRATION OF THE LIBRARY

LIBRARY COMMITTEE

WITMER STONE, *Chairman*, F. J. KEELEY
 HENRY TUCKER T. CHALKLEY PALMER
 SPENCER TROTTER.

SPENCER TROTTER, *Librarian*.
 WILLIAM J. FOX, *Assistant Librarian*.

During 1922, the additions to the library total 7,168. The apparent decrease, from the total for 1921, is due to the receipt in the former year of 581 autograph letters of the late S. S. Haldeman, so that there is an actual increase in the accession of books and pamphlets. Pamphlets and parts of periodicals received during the year amounted to 6,270. Of these 717 are volumes, 146 maps, 1 printed sheet, and 34 photographs.

The sources of accession are as follows:

Exchange.....	3541
Isaiah V. Williamson Fund.....	2122
United States Department of Agriculture.....	548
General Appropriation for Purchase of Books.....	256
Authors.....	70
Texas Agricultural Experiment Station.....	47
Pennsylvania Bureau of Topographic and Geologic Survey.....	46
Mr. Clarence B. Moore.....	41
Pennsylvania State Library.....	35
Estate of Frank Thomson.....	34
Trustees of British Museum (Natural History).....	30
Editors.....	28
New York State College of Agriculture.....	26
Cornell University Agricultural Experiment Station.....	21
American Entomological Society.....	19
Provincial Museum, Toronto, Canada.....	14
Department of Archives and History, Alabama.....	13

Museum of the American Indian, Heye Foundation.....	13
Thomas B. Wilson Fund.....	12
Zoological and Acclimatisation Society of Victoria.....	12
Biological Board of Canada.....	10
New York Agricultural Experiment Station.....	10
United States Department of Commerce.....	10
Cuperpo de Ingenieros de Minas del Peru.....	9
Dr. Henry A. Pilsbry.....	9
Wyoming State Geologist.....	9
Queensland Department of Mines.....	8
Vermont Agricultural Experiment Station.....	8
Imperial Department of Agriculture of the British West Indies.....	8
Indiana University.....	7
Tennessee State Geological Survey.....	7
State of New York Conservation Commission.....	7
Department of Agriculture, State of California.....	6
Florida State Geological Survey.....	6
Oklahoma Geological Survey.....	6
Publication Committee of the Academy.....	6
Geological Survey of Alabama.....	5
Scripps Institute for Biological Research.....	5
Statens Skogsförsöksanstalt, Stockholm.....	5
Argentine Government.....	4
California Fish and Game Commission.....	4
Kentucky Geological Survey.....	4
National Research Council of Japan.....	4
Virginia Geological Commission.....	4
Agricultural Experiment Station of Colorado Agricultural College.....	3
Albert Ier, Prince de Monaco.....	3
Bristol Museum and Art Gallery.....	3
Mr. F. Lynwood Garrison.....	3
Louisiana Commissioner of Agriculture and Immigration.....	3
Michigan Geological and Biological Survey.....	3
Roger Williams Park Museum.....	3
University of Tennessee.....	3
Utah Agricultural College Experiment Station.....	3
Dr. William L. Abbott.....	2
Massachusetts Commission on Fisheries and Game.....	2
National Academy of Sciences.....	2
San Francisco Bay Marine Piling Survey.....	2
Scientific Society of San Antonio.....	2
Mr. Frederick D. Shelton.....	2
United States War Department.....	2
Zoological Society of Philadelphia.....	2
Biological and Microscopical Section of the Academy.....	1
Board of Scientific Advice for India.....	1
Board of Water Supply of City of New York.....	1

Boston City Hospital.....	I
Canada. Department of Marine and Fisheries.....	I
City Library Association of Springfield, Mass.....	I
Colorado Mountain Club.....	I
Colorado Museum of Natural History.....	I
Danish Government.....	I
Department of Trade and Customs, Australia.....	I
Direccion de la Edicion Oficial de las Obras y Correspondencia Cientifica de Florentino Ameghino.....	I
Estate of Edward J. Nolan.....	I
Mr. William J. Fox.....	I
French Government.....	I
Geological Survey of the Dominican Republic.....	I
Geological Survey of Georgia.....	I
Hawaiian Islands Committee of the Press Congress of the World.....	I
Hercules Powder Company.....	I
Imperial Entomologist, India.....	I
Japan Society.....	I
Messrs. Lemcke & Buechner, New York.....	I
Louisiana State Museum.....	I
Michigan College of Mines.....	I
Ministère des Colonies, Belgium.....	I
National Research Council.....	I
New Jersey Department of Conservation and Development.....	I
New South Wales, State Fisheries.....	I
New York State Archeological Association, Morgan Chapter No. 1.....	I
Philadelphia-Interstate Dairy Association Council.....	I
Philadelphia Museums.....	I
Rockefeller Foundation International Health Board.....	I
Society of Economic Geologists.....	I
South Dakota Geological and Natural History Survey.....	I
Southwest Museum.....	I
United States Brewers' Association.....	I
Warren Academy of Sciences.....	I

These have been distributed to the various departments of the library as follows:

Journals.....	5182
Agriculture.....	739
Geology.....	561
Botany.....	143
General Natural History.....	88
Entomology.....	79
Voyages and Travels.....	75
Geography.....	72
Anthropology.....	57
Anatomy and Physiology.....	40

Ornithology.....	31
Mineralogy.....	22
Helminthology.....	15
Conchology.....	13
Mammalogy.....	11
Ichthyology.....	9
Herpetology.....	8
Bibliography.....	6
Chemistry.....	4
Physical Sciences.....	3
Medicine.....	2
Encyclopedias.....	3
Miscellaneous.....	5

The following new journals and transactions were added to the library either by exchange or purchase:

- Academia Aboensis, Abo. Acta, Mathematica et Physicae.
 Academy of Natural Sciences of Philadelphia. Special Publication.
 Agricultural Bulletin of the Federated Malay States. Kuala Lumpur.
 Agricultural Gazette of Canada. Ottawa.
 Archives néerlandaises de Physiologie de l'Homme et des Animaux. La Haye.
 Asociacion Peruana para el Progreso de la Ciencia. Archivos.
 Association of Official Seed Analysts of North America. Proceedings.
 Arbeiten des geographischen Instituts der deutschen Universität in Prag.
 Arnold Arboretum, Journal.
 Australian (The) Naturalist. Sydney.
 Botanisches Archiv. Königsberg Pr.
 Botanisch-phaenologische Beobachtungen in Böhmen. Prag.
 Capita Zoologica. 'sGravenhage.
 City Library Association of Springfield, Massachusetts. Annual Report.
 Colorado Mountain Club, Denver. Publication.
 Commission Internationale pour l'Exploration Scientifique de la Mer Méditerranée. Bulletin.
 Den II. Thule Ekspedition til Gronlands Nordkyst 1916-18.
 Dove Marine Laboratory (Northumberland Sea Fisheries Committee). Report.
 Globen. Stockholm.
 Guam Agricultural Experiment Station. Bulletin.
 Hamburgisches Kolonialinstitut, Hamburg. Abhandlungen, Reihe B, C, D.
 Imperial Plant Quarantine Station, Yokohama. Bulletin.
 Japanese Journal of Botany. Tokyo.
 Japanese Journal of Geology and Geography. Tokyo.
 Kungl. Vitterhets Historie och Antiquitets Akademien. Handlingar.
 Laboratoire de Biologie générale Institut M. Nencki, Prag. Travaux.
 Laboratoire Neurobiologique de l'Institut M. Nencki, Prag. Travaux.
 Madras Government Museum, Madras. Administration Report.
 Malayan Agricultural Journal. Kuala Lumpur.
 Museo Nacional de Arqueologia, Historia y Etnografia, Mexico. Boletin.

- Natural History Society of Hartford. Transactions.
 Naturwissenschaftliche Schriften. Prag.
 Nebraska Ornithological Union. Proceedings.
 North Carolina Geologic and Economic Survey, Forestry Division. Circular.
 Oberösterreichischer Musealverein, Linz. Jahresbericht.
 Oberrheinischer Geologischer Verein. Berichte über die Versammlung. Jahres-Berichte und Mitteilungen.
 Pan-American Geologist.
 Philadelphia Zoological Society. Contributions from Laboratory of Comparative Pathology.
 Public Museum of City of Milwaukee. Year Book.
 Review of Applied Mycology. Kew.
 Revue générale de Botanique appliquée, etc. Paris.
 Russian Hydrobiological Journal. Saratov.
 San Francisco Bay Marine Piling Survey. Annual Report.
 Schweizerische Mineralogische und Petrographische Mitteilungen.
 Société d'Histoire Naturelle de l'Afrique du Nord, Alger. Bulletin.
 Society of Economic Geologists. Summary of Proceedings.
 Southern Ussuri Branch of the Russian Geographical Society. Bulletin. Memoirs.
 Stadtische Völker-Museum. Frankfurt a. M. Veröffentlichungen.
 State of New York Conservation Commission. Annual Report.
 Supplements au Bulletin Biologique de France et de Belgique. Paris.
 Topographische Dienst in Nederlandsch-Indië, Batavia. Jaarsverslag.
 Union of South Africa Mines Department Geological Survey. Memoirs. Explanation of Sheets. Maps.
 United States Department of Agriculture. Pathological Herbarium Notes.
 Université de Neuchatel. Mémoires. Theses.
 Vermont. Report of State Geologist.
 Warszawskie Towarzystwo Politechniczne, Warsaw. Sprawozdania i Prace.
 Zeitschrift f. gesamte Anatomie. Abt. III (Ergebnisse der Anatomie und Entwicklungsgeschichte).
 Zoologische Berichte. Jena.

A copy of the scarce "An Epitome of the Natural History of the Insects of New Holland, New Zealand, New Guinea," etc., by E. Donovan, 1805, was acquired by purchase; and a copy of LeMoyne, "Indorum Floridam Provinciam Inhabitatium Eicones," etc., 1591, was received, with other valuable works on anthropology, as a gift from Mr. Charles B. Moore.

Nine hundred and sixty-two volumes were bound and 12 repaired.

Twenty-three volumes and 120 pamphlets, not germane to the Academy's library, were transferred to the Free Library of Philadelphia.

Sixteen hundred and twenty-one volumes were used on premises by the scientific staff; and 221 were borrowed by members.

The Librarian wishes to acknowledge his appreciation of the important and valuable work of Mr. William J. Fox, Assistant Librarian, in the care of the Library; and also of the help constantly rendered by Miss H. Newell Wardle.

SPENCER TROTTER,
Librarian.

PUBLICATIONS

PUBLICATION COMMITTEE

HENRY A. PILSBRY, *Chairman*, WITMER STONE,
WILLIAM J. FOX, MILTON J. GREENMAN, J. PERCY MOORE.

Editor: WILLIAM J. FOX.

Artist: HELEN WINCHESTER.

Owing to a change in the issue of the PROCEEDINGS, from three parts each year to a single volume, which cannot be issued until after January 1, 1923, nothing has been distributed of this publication, except the reprints of the separate papers which are sent out to obtain a date of issue. The volume when completed will contain approximately 310 pages and twenty-two plates.

The ANNUAL REPORTS for 1921, have been issued and distributed to members. They consisted of seventy-four pages and sixteen half-tone illustrations.

Of the ENTOMOLOGICAL NEWS, published by the Entomological Section of the Academy, 333 pages and 11 plates were issued; and the American Entomological Society published 355 pages and 18 plates of its TRANSACTIONS.

Parts 104 and 105 of the MANUAL OF CONCHOLOGY, with 142 pages and 11 plates, have been issued under the editorship of Dr. Pilsbry.

The Academy has published "The Mineralogy of Pennsylvania," by Samuel G. Gordon, a volume of 160 pages and 110 text illustrations, and a frontispiece. This volume forms the initial number of a new series entitled SPECIAL PUBLICATION.

Exchange of publications, interrupted during the world war, has been resumed with correspondents in Roumania, Servia, and Ukrainia; and through the intermediary of the American Relief Administration it was possible to forward to correspondents in Russia, all the publications withheld during the war period.

WILLIAM J. FOX,

Secretary of the Committee.

SECRETARIES

REPORT OF THE RECORDING SECRETARY

During the past year seven meetings of the Academy have been held, six being stated meetings and one an adjourned session to elect members. The dates of the meetings were December 20, 1921; January 17, February 21, March 21, April 18, which meeting adjourned to reassemble at the call of the President, the adjourned session on June 20, and November 21, 1922. The average attendance at the meetings was twenty-two members and twenty-four visitors. Communications were made by Dr. Edwin G. Conklin, Dr. C. Montague Cooke, Henry W. Fowler, Samuel G. Gordon and Wharton Huber.

During the past year thirteen members have died and four have resigned. The losses by death included: Charles Morris, Chairman of the Committee on Accounts of the Academy and a Councilor since 1884, as well as having served at one time as a member of the Committee on Finance, and for many years on the Committee on Instruction; George Spencer Morris, a Curator of the Academy, long a member of the Committee on Instruction, and Councilor for a number of years.

The following were elected members:

Dr. Francis Heed Adler, Miss Alice O. Albertson, Dr. Francis O. Allen, Jr., Dr. Joseph L. T. Appleton, Jr.

Joshua L. Baily, Jr., John Bancroft, Samuel H. Barker, John Hampton Barnes, Leonard T. Beale, Charles Biddle, Commander Clement Biddle, Malcolm H. Bissell, Dr. Theodore W. Bouchelle, Stanley Bright, Joseph H. Bromley, Carolus M. Bromall, William Findlay Brown, Orville H. Bullitt, Miss Martha Bunting.

Miss Sophia Cadwalader, Miss M. H. Cadwalader, Daniel H. Carstairs, John P. Carter, Mrs. Samuel Chew, Clarence M. Clark, Miss M. E. Converse, Henry B. Coxe, Robert M. Coyle, Theodore W. Cramp, James H. R. Cromwell, Samuel M. Curwen.

Charles Day, William D. Disston, Miss Mary A. Dobbins, Col. Franklin D'Olier, Mrs. Franklin D'Olier, Mrs. William Dreer, Mrs. G. W. C. Drexel, Henry S. Drinker, Jr., Irénée du Pont.

Louis H. Eisenlohr, William M. Elkins, William Struthers Ellis, Van Horn Ely, George K. Erben.

Charles Fearon, Thomas T. Firth, N. T. Folwell, Stanley Folz, Frank N. Foster, Mrs. L. Webster Fox, Samuel M. Freeman, Mrs. John Fritsche, Mrs. H. H. Furness, Jr.

John T. Garman, Dr. Arthur Howell Gerhard, Dr. Alfred Gordon, Frank T. Griswold, Dr. Alexander S. Gross, S. R. Guggenheim.

Arthur F. Hagar, Mrs. George L. Harrison, Jr., Frank Hart, William H. Hart, R. Wistar Harvey, Henry Reed Hatfield, William E. Helme, Mrs. Frederick Hemsley, W. E. Hering, Charles E. Hires, George Gowen Hood, Mrs. Samuel F. Houston, John J. Howard, Mrs. H. M. Howe, Mrs. Charles Willing Huber, John F. Huneker, Frederick B. Hurlburt, Miss A. P. Hutchinson, Daniel P. Hutchinson, Jr., Dr. Robert H. Hutchison,

Joseph Y. Jeanes, Dr. Edward M. Jefferys, Edward Hine Johnson, Livingston E. Jones.

Francis Fisher Kane, Dr. Peter M. Keating, Dr. Edward C. Kirk, Rev. Archibald C. Knowles, Gustavus W. Knowles.

Dr. H. Pearce Lakin, Arthur H. Lea, Mrs. Arthur H. Lea, Charles M. Lea, Miss Nina Lea, Elisha Lee, Dr. Henry Leffmann, Howard W. Lewis, Samuel N. Lewis, M. Albert Linton, Miss Caroline Lippincott, Mrs. J. Bertram Lippincott, Horatio Gates Lloyd, Mrs. Horatio Gates Lloyd, Malcolm Lloyd, Jr., Dr. Edward Lodholz, Miss Eleanor Tatum Long, John C. Lowry, Charles H. Ludington.

Dr. Thomas McCrae, Mrs. George D. McCreary, Mrs. Charles J. McIlvain, Jr., Walter S. McInnes.

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C. Edgar Ogden.

George R. Packard, T. H. Hoge Patterson, Dr. Ralph Pemberton, George L. Pennock, Hon. George Wharton Pepper, Charles P.

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Evan Randolph, Mrs. Evan Randolph, Samuel Rea, Miss Marion Reilly, Dr. Stanley P. Reimann, Thomas de Q. Richardson, Dr. David Riesman, George S. Robbins, Frank C. Roberts, J. Clifford Rosengarten.

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Roland L. Taylor, George C. Thayer, Mrs. George C. Thomas, Dr. M. Carey Thomas, Nicolas Thouron, Robert J. Titherington, John B. Townsend, Carroll S. Tyson, Jr., Mrs. Carroll S. Tyson, Jr. Dr. B. M. Underhill.

Samuel Tobias Wagner, F. King Wainwright, Clarence A. Warden, Alfred S. Weill, Daniel B. Wentz, Mrs. Harry F. West, Mrs. S. P. Wetherill, William H. Wetherill, Dr. Edward E. Wildman, Dr. DeForest P. Willard, Henry S. Williams, Dr. L. C. Wills, Joseph Lapsley Wilson, Mrs. William D. Winsor, Clement B. Wood, Miss Marion B. Wood, Mrs. George Woodward.

Associate Members: Dr. Levi W. Mengel, and Earl L. Poole, both of Reading, Pennsylvania.

Junior Members: Edward P. Bromley, Henry S. Bromley, Jr., Franklin P. Cook, Anne Conrad D'Olier, Franklin D'Olier, Jr., Helen Kitchen D'Olier, Jr., John T. Emlen, Jr., John M. Fisher, Jr., William P. Harrington, Charles Eliot Underdown, George Vaux, X., Henry James Vaux.

By direction of the Council, the second stage of the membership campaign was carried out, with most gratifying success. Two hundred and seventeen members of all classes were added to the rolls of the Academy, which after the death and resignation losses of the year show a net gain of two hundred.

In appreciation of their monetary gifts to the Academy for general or special purposes, by action of the Council, Mr. Clarence B. Moore

was designated a Benefactor, and John Cadwalader, Mrs. Samuel G. Dixon, Morgan Hebard, Effingham B. Morris, and Mrs. Beulah M. Rhoads, as Sustaining Members.

The Recording Secretary desires to express his appreciation of the cordial assistance and helpful suggestions given by officers and councilors of the Academy, during a year crowded with irksome routine details. It is a distinct pleasure to realize that the Council of the Academy has authorized the inauguration, in the near future, of a Central Office, which will relieve the Secretaries and other officers of the Academy of much purely clerical routine, which now consumes time of far greater value to the Academy.

JAMES A. G. REHN,
Recording Secretary.

REPORT OF THE CORRESPONDING SECRETARY

Correspondents deceased during the year are H. R. H. Albert I, Prince of Monaco, and Alfred Goldsborough Mayor. No correspondents were elected.

Among important scientific activities in which the Academy was invited to participate were: the semicentennial of the founding of the museum of the Ethnological Society of Leipzig; the one hundred and fiftieth anniversary of the founding of the Royal Belgian Academy; the twenty-sixth annual meeting of the American Academy of Political and Social Science; the national committee to found a Spencer F. Baird memorial, on which Dr. R. A. F. Penrose, Jr., was appointed as the Academy's representative; the Thirteenth International Geological Congress at Brussels, to which Dr. Penrose also went as the Academy's delegate; the Twentieth International Congress of Americanists at Rio de Janeiro, at which the Academy was represented by Dr. William P. Wilson; a proposed memorial foundation at Brussels to Maurice Rahir, in the form of a prize to be awarded for distinguished geographical discovery; the seventieth birthday jubilee of Victor Goldschmidt; and the inauguration of Marion Edwards Parks as President of Bryn Mawr College. In cases where the Academy was unable to appoint a delegate, congratulatory letters, or suitable acknowledgments, were sent.

A handsome bronze medallion, commemorating the one hundred and fiftieth anniversary of the Royal Belgian Academy of Sciences, Letters and Fine Arts, was received.

The usual routine correspondence and exchange of courtesies were conducted.

Statistics of correspondence follow:

Communications received:	
Acknowledging the receipt of the Academy's publications.....	169
Transmitting publications to the Academy.....	59
Requesting exchanges or the supply of deficiencies.....	67
Photographs of correspondents.....	2
Invitations to learned gatherings, etc.....	14
Notices of deaths of scientific men.....	3
Circulars concerning the administration of scientific and educational institutions, etc.....	24
Letters from correspondents and miscellaneous letters.....	103
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Total received.....	443

Communications forwarded:	
Acknowledging gifts to the Library.....	1202
Requesting the supply of deficiencies in periodicals.....	438
Acknowledging gifts to the Museum.....	146
Acknowledging photographs and biographies of correspondents.....	2
Letters of sympathy or congratulations, addresses, etc.....	16
Diplomas of correspondents and delegates' credentials.....	3
Miscellaneous letters.....	177
Annual Reports.....	280
<hr/>	
Total forwarded.....	2264

J. PERCY MOORE,
Corresponding Secretary.

CENTRAL OFFICE
Bursar: Florence E. Franck.

TREASURER

SUMMARY OF THE ACCOUNTS OF GEORGE VAUX, JR.,
TREASURER OF THE ACADEMY OF NATURAL
SCIENCES OF PHILADELPHIA, FOR
THE FISCAL YEAR ENDING
NOVEMBER 29TH, 1922.

GENERAL FUND

RECEIPTS

Balance on hand 30th November, 1921.....	\$ 2,057.31
Income from Investments.....	45,107.49
Income from the Estate of John Turner.....	150.48
Annual Dues.....	3,786.00
Interest on Bank Balances.....	580.39
Publications sold.....	434.96
Account of 1309 Arch Street,-Cancellation of Insurance Policies....	86.75
Transfer from Special Funds:—	
Jeanes Fund for Museum Expenses.....	950.00
Wilson Fund for Librarian's salary.....	400.00
	<u>\$53,553.38</u>

PAYMENTS

General expenses, including fuel, light, water and building repairs..	\$ 4,876.89
Salaries in Curators' Department.....	31,946.10
Museum Cases.....	811.99
Specimens and Expeditions.....	1,015.38
Salaries in Librarian's Department.....	2,274.92
Librarian's expenses.....	124.46
Books.....	1,453.62
Binding.....	1,501.70
Petty expenses.....	350.00
Printing Proceedings.....	2,376.30
Mineralogy of Pennsylvania.....	1,770.25
Recording Secretary, salary and expenses.....	1,496.02
Corresponding Secretary's expenses.....	50.00
Expenses of Treasurer's Department.....	430.00
Mary S. Warren, on account of 1309 Arch Street.....	1,800.00
Estate of Robert H. Lamborn, deceased, for taxes, etc. on lands in Colorado and Minnesota.....	800.00
Balance on hand 29th November, 1922.....	<u>475.75</u>
	<u>\$53,553.38</u>

ANNUAL REPORTS OF ACADEMY OF
CONCHOLOGICAL SECTION FUND

RECEIPTS

Net Income collected.....	\$1,264.30
	<u>\$1,264.30</u>

PAYMENTS

Balance overdrawn 30th November, 1921.....	\$ 912.37
Balance on hand 29th November, 1922.....	<u>351.93</u>
	<u>\$1,264.30</u>

COPE COLLECTION FUND

RECEIPTS

Balance on hand 30th November, 1921.....	\$3,147.98
Net Income collected.....	<u>782.87</u>
Balance on hand 29th November, 1922.....	<u>\$3,930.87</u>

F. V. HAYDEN MEMORIAL FUND

RECEIPTS

Balance on hand 30th November, 1921.....	\$ 51.23
Net Income collected.....	<u>102.22</u>
Balance on hand 29th November, 1922.....	<u>\$153.45</u>

HORACE N. POTTS FUND

RECEIPTS

Balance on hand 30th November, 1921.....	\$475.32
Net Income collected.....	<u>304.02</u>
Balance on hand November 29th, 1922.....	<u>\$779.34</u>

MARY JEANES MUSEUM FUND

RECEIPTS

Balance on hand 30th November, 1921.....	\$ 83.79
Net Income collected.....	<u>870.70</u>
	<u>\$954.49</u>

PAYMENTS

Transferred to General Fund for Museum Expenses.....	\$950.00
Balance on hand 29th November, 1922.....	<u>4.49</u>
	<u>\$954.49</u>

JESSUP FUND, MALE BRANCH

RECEIPTS

Balance on hand 30th November, 1921.....	\$ 504.55
Net Income collected.....	630.03
	<u>\$1,134.58</u>

PAYMENTS

Salaries to Students.....	\$1,125.00
Balance on hand 29th November, 1922.....	9.58
	<u>\$1,134.58</u>

JESSUP FUND, FEMALE BRANCH

RECEIPTS

Balance on hand 30th November, 1921.....	\$ 92.49
Net Income collected.....	222.86
	<u>\$315.35</u>

PAYMENTS

Salaries to Students.....	\$240.00
Balance on hand 29th November, 1922.....	75.35
	<u>\$315.35</u>

J. A. MEIGS LIBRARY FUND

RECEIPTS

Net Income collected.....	\$ 520.70
Balance overdrawn 29th November, 1922.....	570.38
	<u>\$1,091.08</u>

PAYMENTS

Balance overdrawn 30th November, 1921.....	\$1,067.24
Books purchased.....	23.84
	<u>\$1,091.08</u>

J. H. REDFIELD MEMORIAL FUND

RECEIPTS

Balance on hand 30th November, 1921.....	\$456.36
Net Income collected.....	172.61
	<u>\$628.97</u>

PAYMENTS

Purchase of pressed plants, etc.....	\$ 88.54
Balance on hand 29th November, 1922.....	540.43
	<u>\$628.97</u>

ANNUAL REPORTS OF ACADEMY OF
MARY REBECCA DARBY SMITH FUND

RECEIPTS	
Balance on hand 30th November, 1921.....	\$184.53
Net Income collected.....	<u>71.52</u>
Balance on hand 29th November, 1922.....	<u><u>\$256.05</u></u>

AUBREY H. SMITH FUND

RECEIPTS	
Balance on hand 30th November, 1921.....	\$2,481.16
Net Income collected.....	<u>735.52</u>
Balance on hand 29th November, 1922.....	<u><u>\$3,216.68</u></u>

FRANCIS LEA CHAMBERLAIN FUND

RECEIPTS	
Balance on hand 30th November, 1921.....	\$591.21
Net Income collected.....	<u>110.83</u>
Balance on hand 29th November, 1922.....	<u><u>\$702.04</u></u>

THOMAS B. WILSON FUND

RECEIPTS	
Balance on hand 30th November, 1921.....	\$ 97.98
Net Income collected.....	<u>489.83</u>
	<u><u>\$587.81</u></u>
PAYMENTS	
Books Purchased.....	\$185.00
Transferred to General Fund for Librarian's salary.....	400.00
Balance on hand 29th November, 1922.....	<u>2.81</u>
	<u><u>\$587.81</u></u>

WILLIAM S. VAUX FUND

RECEIPTS	
Balance on hand 30th November, 1921.....	\$ 835.08
Net Income collected.....	<u>526.50</u>
	<u><u>\$1,361.58</u></u>
PAYMENTS	
Minerals purchased.....	\$ 720.84
Balance on hand 29th November, 1922.....	<u>640.74</u>
	<u><u>\$1,361.58</u></u>

I. V. WILLIAMSON FUND

RECEIPTS

Net Income collected.....	\$1,840.26
	<u>\$1,840.26</u>

PAYMENTS

Balance overdrawn 30th November, 1921.....	\$ 115.30
Books purchased.....	1,476.74
Balance on hand 29th November, 1922.....	248.22
	<u>\$1,840.26</u>

SPECIAL DONATION FUND

RECEIPTS

Balance on hand 30th November, 1921.....	\$ 521.33
Donations received.....	4,809.00
	<u>\$5,330.33</u>

PAYMENTS

Purchase of Cases, Expeditions, etc.....	\$3,134.75
Balance on hand 29th November, 1922.....	2,195.58
	<u>\$5,330.33</u>

J. F. BEECHER MEMORIAL LABRATORY FUND

RECEIPTS

Balance on hand 30th November, 1921.....	\$3,170.66
Net Income collected.....	889.41
Balance on hand 29th November, 1922.....	<u>\$4,060.07</u>

GENERAL ENDOWMENT FUND

RECEIPTS

Balance on hand 30th November, 1921.....	\$553.46
Net Income colleted.....	179.68
Balance on hand 29th November, 1922.....	<u>\$733.14</u>

Respectfully submitted,

GEORGE VAUX, JR.,

Treasurer.

E. and O. E.

Philadelphia,

December 1st, 1922.

We herewith report that we have made an audit of the books and accounts of George Vaux, Jr., Esq., Treasurer of the Academy of Natural Sciences, Philadelphia, Pa., for the fiscal year ended November 29th, 1922.

As the result of our audit we certify that these statements are in accord with the records of the Girard Trust Company, Agent, and with the Treasurer's books, respectively, and are in our opinion correct.

All of the income received during the year was accounted for and entered upon the books. The payments, as shown by the Cash Book, were properly supported by statements, checks or vouchers and were found to be correct. A reconcilliation of the deposit account with the Girard Trust Company was made by us and the correctness of the Cash Balance as shown by the Treasurer's books verified thereby.

(Signed) EDWARD P. MOXEY & Co.
Certified Public Accountants.

REPORT OF THE TREASURER OF THE MANUAL OF CONCHOLOGY

The Treasurer of the "Manual of Conchology" respectfully reports that during the year ending December 1, 1922, the receipts from all sources were:

.....	\$1,738.60
And disbursements.....	643.14
	<hr/>
Leaving a balance.....	1,095.46
Adding to this, balance Dec. 1, 1921.....	519.48
	<hr/>
Leaves balance, Dec. 1, 1922.....	<u>\$1,614.94</u>

The receipts were as follows:

From Manual subscriptions, Vol. XXV.....	\$ 6.40
" Manual subscriptions, Vol. XXVI.....	542.03
" Manual subscriptions, Vol. XXVII.....	257.90
" Sale, back vols. and parts.....	917.48
" Interest, daily Bank Balances.....	14.79
	<hr/>
	<u>\$1,738.60</u>

The disbursements were:

Colorists.....	\$ 45.00
Lithographing plates.....	60.18
Paper and printing.....	398.42
Binding parts.....	37.63
Postage, expressage, etc.....	40.91
Advertising.....	4.00
Transfer from depcsit account, Wm. Wesley and Son.....	57.00
	<hr/>
	643.14
Balance on hand.....	<u>\$1,614.94</u>

The balance on hand is subdivided as follows:

For Manual of Conchology.....	\$1,594.69
Wm. Wesley and Son, Deposit subject to demand.....	19.25

The editorial services and the expenses incurred in draughting plates, continue to be assumed by the Publication Committee of the Academy.

Respectfully Submitted,
S. RAYMOND ROBERTS,
Treasurer.

December 1, 1922.
Examined and found correct,
R. C. WILLIAMS, JR.

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OF

THE ACADEMY OF NATURAL SCIENCES

OF PHILADELPHIA*

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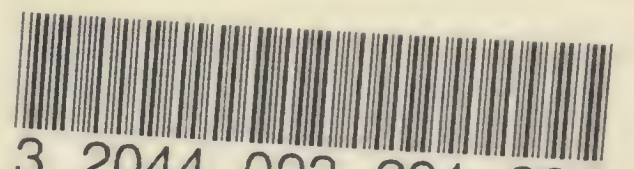
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